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THE ROBUSTNESS OF INTERNATIONAL BENCHMARKS OF COMPETITION INTENSITY: THE CASE OF MARK-UPS

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Working Paper 2008-10

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Abstract

In several recent publications, the Organisation for Economic Co-operation and Development (OECD) argues that, in general, competitive forces appear to be relatively strong in Canada compared to other OECD countries. This conclusion is based on a series of imperfect proxies that attempt to measure the intensity of competition such as industrial concentration measures, import-penetration rates and relative mark-ups of industries across countries. In this paper, we review the robustness of such an international benchmarking exercise and particularly focus on mark-ups obtained from models developed by Hall (1988) and Roeger (1995). Using these models, we show the substantial and significant sensitivity of the estimated mark-ups to several underlying assumptions such as the time period and the rental price of capital. We then argue that this particular indicator of competition intensity and market power should be used with great caution in any international benchmarking exercise and that other indicators provide more robust estimates of competition intensity

Key words: mark-ups, imperfect competition, market power

Résumé

Dans quelques publications récentes, l'Organisation de coopération et de développement économique (OCDE) affirme que, en général, la concurrence semble relativement forte au Canada comparativement aux autres pays de l'OCDE. Cette conclusion est basée sur une série d'approximations imparfaites qui tentent de mesurer l'intensité de la compétition, comme des mesures de la concentration industrielle, de la pénétration des importations et des taux de marge relatifs des industries dans divers pays. Dans la présente étude, nous examinons la fiabilité de pareil exercice de comparaison et nous nous concentrons particulièrement sur les taux de marge obtenus par les modèles créés par Hall (1988) et Roeger (1995). L'utilisation de ces modèles montre une sensibilité importante et significative des taux de marge estimés à des facteurs sous-jacents tels la période observée ou le prix de location du capital. Nous affirmons ensuite que l'indicateur de l'intensité de la compétition et du pouvoir de marché en question devrait être utilisé avec beaucoup de prudence dans tout exercice de comparaison internationale et que d'autres mesures donnent des estimations plus fiables de l'intensité de la compétition.

Mots clés : taux de marge, imperfection de la concurrence, pouvoir de marché

1. INTRODUCTION

The Organisation for Economic Co-operation and Development (OECD) argues that, in general, competitive forces appear to be relatively strong in Canada compared to other OECD countries.[1] This conclusion is based on a series of imperfect proxies that attempt to measure the intensity of competition such as industrial concentration measures, import-penetration rates and relative mark-ups of industries across countries.

The purpose of this paper is to review the robustness of such an international benchmarking exercise and particularly focus on mark-ups obtained from models developed by Hall (1988) and Roeger (1995). We apply different methods to test the robustness of the model with regards to several underlying assumptions such as the time period selected, the rental price of capital and the industrial level of aggregation, over an extended number of industries across countries. Our results show the substantial and significant sensitivity of the estimated mark-ups to the underlying assumptions. For instance, by applying a simple change in the calculation of the rental price of capital, our results show significant differences in the Electricity, Gas & Water and Financial Intermediation sectors, where our coefficients are almost twice the value of those estimated by the OECD for Canada. We also discuss some challenges associated with the interpretation of the mark-ups in measuring competition. Finally, we argue that other indicators provide more robust estimates of competition intensity.

The paper is organized as follows. The next section provides the theoretical background to the measurement of mark-ups as well as the methodological issues. The third section compares our results with the OECD, tests the robustness of the model and conducts an international benchmarking exercise for different periods of time. The fourth section questions the use of mark-ups to benchmark competition intensity and suggests some alternatives. The final section draws some conclusions.

2. Benchmarking Competition: The Use of Mark-ups

2.1 Measuring Competition

The notion of competition intensity is of broad interest to economists and often finds itself the subject of comparisons between different countries. However, competition is a complex and multi-dimensional phenomenon. The state of competition is difficult to measure as it is influenced by a number of factors such as the definition of the market, the number of firms in the market (i.e. degree of concentration), similarity among products, firms' behavior and strategic interaction (i.e. collusion), the institutional settings (i.e. regulation, barriers to entry, government policies), etc. Because of these factors, a coherent definition or robust measurement of competition does not exist [Boone (2000)].

Still, some measures have been used in the literature as proxies to estimate competition intensity such as regulation measures, concentration ratios, import penetration and price-

[1] See amongst others *OECD Economic Survey Canada* (2004), Maher, M. (2005) *Product Market Competition in OECD Countries: A synthesis*, and *OECD Economic Survey – Canada* (2006a).

cost margin (PCM), the so-called Lerner index or mark-ups.[2] Among those imperfect measures, the Lerner index is often considered one of the best proxies to measure competition intensity [Nickell (1996), Boone (2000)]. Nonetheless, Thille (2006) argues that those "traditional" measures, including mark-ups, are not direct measures of competition intensity and can be misleading.

The OECD has published several studies trying to benchmark competition intensity across countries and industries using some of those indicators[3] and argues that in general, competitive forces appear to be relatively strong in Canada compared to other OECD countries. More precisely, the OECD argues that competition intensity in Canada appears to be average or slightly higher than the other OECD countries in the manufacturing sector, because industry concentration and mark-ups are relatively low compared to other OECD countries. Likewise, they mentioned that the manufacturing sector faces vigorous competition from abroad, reflecting Canada's open economy. Canada also fares well in most non-manufacturing industries except in the Telecommunications, Electricity & Natural gas and Airline sectors where product market competition could be strengthened. The OECD (2004) also argues that, when measured by the Herfindahl Hirschman index (HHI), Canadian manufacturing industries are slightly less concentrated than in the United States (U.S.). On the other hand, Crépeau & Duhamel (2006) and Thille (2006) point out that the OECD might have underestimated the HHI level for Canada and that more disaggregated data show that the manufacturing industries are more concentrated in Canada than the U.S. However, these studies concentrated on HHI and have not tested the robustness of the mark-ups used by the OECD as an indicator of competition intensity. The next section reviews briefly the theoretical framework used by the OECD to calculate mark-ups.

2.2 OECD Approach to Estimate Mark-ups (The Empirical Model)

The degree of market power in a defined market is often estimated by the gap between the price and the marginal cost. More precisely, the Lerner index (B) measures the difference between price (P) and marginal cost (MC) as a fraction of the price of a product [Lerner (1934)]:

$$Lerner\ index = B = PCM = \frac{P - MC}{P} \quad (1)$$

In industries where firms vigorously compete for customer sales by attempting to charge the lowest price in the market, the Lerner index is close to 0 and when firms do not vigorously compete for customers through price in the market, the Lerner index is closer

[2] The terms Lerner index and mark-ups are used interchangeably throughout the paper. We will see in section 2.2 that even if they do not have the same value, these two concepts are closely related, as mark-up is only a transformation of the Lerner index. In a benchmarking exercise, they will provide the same ranking by country or industry.

[3] OECD (2004, 2006a), Maher (2005) & Martins et al. (1996a & 1996b)

to 1 [Baye (2003)]. In other words, the greater is the index, the greater should be the market power of firms and lower the competition intensity. [4]

The mark-up defines the factor by which marginal cost is multiplied to obtain the price of the good and is directly obtained from equation (1):

$$Mark\text{-}ups = \mu = \frac{P}{MC} = \frac{1}{1-B} \quad (2)$$

While in theory calculating the Lerner index seems appealing to estimate competition intensity, it remains quite a challenge to measure it empirically, because marginal cost are usually not directly observable.

Based on ideas contained in Solow (1957), Hall (1988) and subsequently Roeger (1995), developed a relatively simple methodology to estimate the Lerner index using macroeconomic data. Assuming all the firms in a given sector have the same generic production function, Hall (1998) shows that:

$$SR = \Delta q - \alpha \Delta n - (1-\alpha)\Delta k = (\mu - 1) * \alpha (\Delta n - \Delta k) + \theta \quad (3)$$

where SR= Solow residual, q = output, n = labour input, k = capital input, α is the share of labour value in output value, μ = P/MC, θ is the rate of technical progress and Δ is the log-difference of the corresponding variable.

The intuition behind this model is that under perfect competition and constant returns to scale the Solow residual (SR) should be identical to the rate of technical progress and should not be correlated with the growth rate of the capital/ labour ratio. In other words, the income share of inputs on total revenues should be equal to the input elasticities of the production function, implying that the excess of such elasticities over the revenue share is the excess of price over marginal cost [Hall (1988)]. [5]

Starting from a definition of mark-ups over average cost (AC) [Martins et al. (1996a)] the model provides an estimate of the mark-ups using the average cost:

$$\frac{P}{AC} = \frac{P * Q}{W * N + M * PM + R * K} = \frac{\mu}{\lambda} \quad (4)$$

where AC is the average cost, P, W, PM and R are the price of output (Q), labour (N), intermediate inputs (M) and capital (K) and λ is an index of return to scale [AC/MC]. Assuming constant return to scale such that MC=AC (or $\lambda = 1$) over the relevant period of production, re-arranging and taking the total differential of equation (4) we obtain a

[4] For a more formal demonstration of this relation, see Church & Ware (2000) section 2.4.2.
[5] The Maher (2005) paper (Annex 2) gives an excellent overview of the model developed by Hall (1988) and Roeger (1995).

direct estimation for the Lerner index over average cost [$B=(P-AC)/P$], which is a direct transformation of the mark-ups ($\mu = 1/1-B$):

$$(\Delta P + \Delta Q) - \alpha(\Delta W + \Delta N) - \beta(\Delta PM + \Delta M) - (1-\alpha-\beta)(\Delta R + \Delta K) = B((\Delta P + \Delta Q) - (\Delta R + \Delta K)) + \varepsilon \quad (5)$$

where Δ is the log-difference of the corresponding variable, α is the share of labour value in output value [$(W*N)/(P*Q)$], β is the share of intermediate inputs value in output value [$(PM*M)/(P*Q)$] and ε is the error term. B is an estimation of the Lerner index $(P-AC/P)$.

The left-hand side of the equation (5) represents the Solow residual with variables measured in nominal terms while the explanatory variable is the growth rate of the nominal output/capital ratio.

The equation (5) can be re-arranged this simple way:

$$\Delta y_t = B\Delta x_t + \varepsilon_t \quad (6)$$

where Δy_t is the left-hand side of equation (5), Δx_t the right-hand side of equation (5) and ε_t the error term.

Under constant return to scale, equation (6) gives an unbiased estimate of the Lerner index. However, equation (7) below, derived from equation (4), shows that the Lerner index provides a downward bias under increasing return to scale ($\lambda > 1$) or an upward bias under decreasing return to scale ($\lambda < 1$) of the real B. Moreover, the B estimates are likely to represent a lower bound for industries with large sunk costs or strong adjustment rigidities over the business cycle [Martins et al. (1996a)].

$$\Delta y_t = [\lambda * (B-1)]B\Delta x_t + \varepsilon_t \quad (7)$$

In summary, this approach makes two important assumptions in the calculation of the Lerner index: the constant return to scale in every industry and constant sectoral Lerner index over time. While it is more than likely that constant return to scale will not occur in every industry, the robustness of this hypothesis seems more difficult to verify empirically. This paper focuses more on verifying the latter, which is the constant Lerner index over time. In order to calculate the Lerner index using the OECD methodology and data, we now review the data issues related to the estimation of equation (6).

2.3 Data issues

With the exception of the cost of capital (R), all of the data for the nominal variables [output ($P*Q$), labour ($W*N$), intermediate input ($PM*M$)] are from the 2004 OECD-STAN database. STAN covers about 30 OECD countries for selected manufacturing and non-manufacturing industries (2-3-4 ISIC-rev.3 digit) over the 1970-2003 period. However, missing or unreported data, as well as the period covered differ widely across countries. We also use the STAN database for real capital stock (K) variable except for the U.S., where the data are from the Bureau of Labor Statistics (BLS), as it was not

available from STAN.[6] The countries selected for our analysis are those for which data on gross capital stock were available from STAN and the U.S.[7] Finally, the rental price of capital is not available from STAN and has been calculated using the same methodology developed by Hall (1990) and simplified by Martins et al. (1996a):

$$R = ((i - \pi_e) + \delta) \cdot p_k \quad (8)$$

where i is the nominal long-term interest rate, π_e is the expected inflation rate, δ is the discount rate corresponding to gross capital stock (5%) and p_k is the economy-wide deflator for fixed business investment. All those variables are taken from the OECD Economic Outlook (2006b).

The nominal long-term interest rates (i) were estimated by yields on benchmark government bonds of 10 years. To calculate the rental price of capital, Maher (2005) uses an economy-wide deflator for fixed business investment, which was not available in the Economic Outlook database. Instead, we use the available deflator for total non-residential business investment. The discount rate (δ) is set to 5%, which is equivalent to an average service life of 20 years. Finally, the inflation expectations (π_e) estimates were generated using a Hodrick-Prescott (HP) (1997) filter applied to GDP deflator. The OECD applies a λ value of 1600 for the HP filter. However, according to Backus and Kehoe (1992), the recommended λ for annual data is 100 while Maravall & del Rio (2001) suggest a λ between 6 and 14. Finally, a more recent study done by Ravn and Uhlig (2002) recommends a λ of 6.25. Our conclusion is that the λ term used by the OECD, while appropriate for quarterly data is less appropriate for annual data. However, we will see in the next section that the choice of λ does not affect the estimated Lerner indexes much for most countries and industries.

Finally, one problem that is often related to the calculation of the Lerner index, is the inclusion in the price of the net indirect taxes (or net subsidies). The exclusion of taxes has the effect of putting an upward (downward) bias to the real value of the parameter B. Maher (2005) made a correction for taxes by applying an adjustment factor averaged over all sectors for each country.[8] The adjustment factor is less than two percentage points in most countries, ranging from 0.96 for Korea to 1.01 for Norway. The reason why the tax adjustment is very small is that STAN already discounts value-added and corporate taxes for most countries. When making our benchmarking analysis between countries, we take into account the tax adjustment by using the same ratios calculated by Maher (2005). Nonetheless, this remains a very rough estimation, as the weight is the same for every

[6] Real productive gross capital stock was available from the BLS from 1987-2004.

[7] Capital stock series are not available for all countries and industries. In the Maher (2005) study, the OECD computed new capital stock series where the data was not available by using the perpetual inventory methods from gross fixed capital formation. They also made other hypothesis where gross fixed capital formation was not available [see Annex 2 p.4 of Maher (2005) for more details]. Because of the complexities involved in replicating exactly what they have done, we focus our analysis on the countries and industries for which the capital stock data was available, which give information for most countries. This also assures us that we have a comparable measure of capital used by the OECD.

[8] See Annex 2 p.5 of her paper for more details.

industry and taxation level is assumed to be constant over time. While it does not appear to have a huge impact, Martins et al. (1996a) showed that taxation might differ widely between industries.

In summary, to calculate our Lerner indexes, we used the same data and methodology developed in the OECD paper written by Maher (2005), the only difference in our methodology being a small change in the calculation of rental price of capital due to limited data availability.

3. Analysis

3.1 Comparison of our results with the latest OECD study

In their 2005 paper, the OECD estimated the Lerner index for 17 OECD countries over a certain number of industries.[9] The results from the OECD study are compared with our results (see *Table 1*) obtained by estimating equation (6). According to Annex 2 of the Maher (2005) paper, the estimation period for the coefficients is for 1975-2002 at most and shorter for some countries and sectors. However, no more information is given. Considering that we use the same data source as the OECD, we are confident that we estimated the same periods of time by country and industry. *Table A1* in the Annex shows that the time-period used for the regressions differs widely among countries and industries.

As expected, most of our estimates are comparable with the OECD. This is not a surprise since technically, the only difference between their methodology and ours is the choice of deflator (see previous section) entered in the calculation of the rental price of capital. Nonetheless, some results are significantly different, mainly in the non-manufacturing sector. For Canada, significant differences occurred in the Electricity, Gas & Water supply and Financial Intermediation sectors where our coefficients are almost twice the value of theirs. Hence, a small change in the calculation of rental price of capital (deflator) might have an important impact for some industries.

Like the OECD, we also used a λ of 1600 for the HP filter in the calculation of the price of capital. We saw in the preceding section that this value might not be appropriate. We tested the sensitivity of the results by comparing different λ (6.25, 100 & 1600). In general, this difference in method does not change the value of the coefficient estimated, except for some industries in Finland and Germany where it varies a lot. These differences might be explained by country-specific data factors. However, based on our previous discussion, a λ of 6.25 is used for the remainder of the paper.

[9] See Table 1, Annex 1 of Maher (2005). As per our verification with the OECD, even if it is written that their estimations are "Mark-ups", it is in fact the Lerner indexes that are presented. The results presented in this paper are for the Lerner index only. Nonetheless, as we have seen earlier, this does not change our analysis, as mark-ups are only a simple transformation of the latter.

3.2 Testing for the Robustness of the Model

The main purpose of this paper is to test for the robustness of the estimates and its potential impact in an international benchmarking exercise of competition intensity. We used more disaggregated industry-level data for Canada over the 1981-2001 period to conduct our tests (see *Table 2*).[10]

A common way to test for robustness is to look at the stability of the model over time. In recursive least squares, the equation is estimated repeatedly, using increasingly larger subsets of the sample data. We used three different recursive tests: CUSUM, CUSUM of squares [Brown et al. (1975)] and recursive coefficients. The first two are based on the cumulated sum of the residuals while the recursive coefficient enables us to trace the evolution of estimated coefficients as more and more of the sample data is used in the estimation. The idea behind these tests is to examine whether the parameters of the model are stable across various sub samples.

We conducted the recursive tests for the Canadian industries. The model shows some instabilities for the CUSUM square tests in most manufacturing industries, particularly in the beginning of the 1990s. This is confirmed by the recursive coefficient test where a structural breakdown seems to occur over the same period. This is particularly obvious for the Wood product and Pulp & Paper products industries where there is a jump in the Lerner index around 1992-94 (see *Figures 1 and 2*). Chow (1960) tests were also performed over those years and confirm a structural breakdown during that period. This breakdown could be associated with the Free Trade Agreement (FTE) and the North American Free Trade Agreement (NAFTA) that Canada signed with the U.S. and Mexico. It could also be related to the economic recession that happened in the beginning of the 1990s. A lot of instability also occurs in the service sector. For instance, the Finance, Insurance, Real Estate & Business Services (FIRE) and the Wholesale & Retail trade show a constant downward trend over the 1981-2001 period for the recursive coefficient test (see *Figures 3 and 4*). All those results suggest that the model is unstable over time in calculating the Lerner index. This questions one of the main assumptions of the model, namely the constant sectoral Lerner index over time.

Figures 5 and 6 compare the average Lerner index in selected manufacturing and non-manufacturing industries in Canada in 1981-2001 and two sub-periods 1981-1990 & 1991-2001. The index is higher over the 1991-2001 period than for the 1981-1990 period in all the manufacturing industries except the one for Chemical products. In contrast, it decreased in all non-manufacturing industries, but Construction over the same period. These results provide additional evidence on a possible structural breakdown in the beginning of the 1990s and the sensitivity of the results according to the period chosen.

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[10] We chose that period to maximize the number of industries available. We also tested these estimates for the 1972-2001 period for the few industries where data was available (not presented here) and conducted further tests for other countries. The results of all these additional tests do not change our conclusions presented in this paper.

Finally, most international benchmarking exercises using the Hall (1988) & Roeger (1995) approach involve a high industrial level of aggregation because of data constraints. These estimations assume that there is no volatility within a specific industrial aggregation. We do not have a lot of disaggregated data available, but we conducted this benchmarking exercise for some industries where it was possible. *Figure 7-8 & 9* show some examples of the differences that might exist within an industry in the FIRE, Transport, Storage & Communication and Textile industries respectively. Hence, by using a high-level of aggregation, we might loose some pertinent information considering all the variation that could occur within some industries.

3.3 International Benchmarking Analysis

Bearing in mind the potential problems associated with the robustness of the model mentioned in section 3.2, this section carries out an international benchmarking analysis by using the same period of time for every country and industry. We also look for the evolution in ranking through time between two sub-periods, 1981-1990 and 1991-2001.

Table 3 shows our estimates of the Lerner index for 9 OECD countries that have data available for the 1981-2001 period. It shows Canada's ranking compared to other countries, the highest rank representing the highest Lerner index. We have seen that a higher Lerner index is often associated with lower competition intensity. Canada ranked first or second in 7 of the 12 manufacturing industries, suggesting that competition intensity in Canada might be lower compared to other countries. In the non-manufacturing sectors, the results are mixed. Canada ranks first in the Electricity, Gas & Water Supply sector by having an index much higher than the other countries and ranks second in Mining, Transport & Storage and Post & Telecommunications. Canada appears to have a fairly low Lerner index estimate in Construction and Wholesale & Retail trade, ranking last in those sectors, suggesting a higher level of competition.

However, a simple exercise shows the sensitivity in the rankings. More precisely, we look at the possible changes in Canada's ranking by adding and subtracting one standard error of Canada's Lerner index value and then comparing those values with the regular Lerner index of the other countries (see *Table 3*). By doing this simple test, we can see that Canada's ranking might be highly volatile in some industries, particularly in the manufacturing sector. For example, Canada ranked first in the Transport Equipment sector, but could also ranked last within one standard error. These outcomes suggest that we have to be very careful in the interpretation of the benchmarking results, as the rank might be highly volatile. The comparisons between countries might even be completely irrelevant in the case where the Lerner indexes are not statistically different.

As discussed in section 3.2, a structural breakdown might have occurred in Canada in the beginning of the 1990s. *Figures 10 and 11* compare Canada's ranking among selected OECD countries in manufacturing and non-manufacturing sectors between the 1981-1990 and 1991-2001 periods. The black line takes into account plus or minus one standard error in the Lerner index for Canada and its potential impact on the ranking. In the manufacturing sector, Canada's ranking increased in all industries, except the one for

Chemical & Chemical products, over the 1991-2001 period, suggesting a lower level of competition. In the non-manufacturing sector, Canada's ranking remained unchanged or increased over the 1991-2001 period, suggesting an increase in competition intensity vis-à-vis the other countries.

We have to bear in mind that the interpretation of the results assumes that the Lerner index is a good proxy to measure market power or competition intensity. The following section provides a discussion of limitations involved in the use of mark-ups (or Lerner index) in conducting such exercises.

4. Discussion

Our findings suggest that the approach used by the OECD to benchmark competition intensity across countries by estimating Lerner indices by industry is not robust. In particular, the previous section shows considerable volatility in the estimates (and implied rankings) for almost all Canadian industries. We have shown that the results are quite sensitive to factors such as data availability (e.g. rental price of capital), the time period chosen (e.g. structural breakdowns), and the level of industrial aggregation.

As mentioned earlier, we know mark-ups are an imperfect measure of competition intensity. As pointed out by Maher (2005, p.5.) some country- or industry-specific factors might have to be considered: *"In addition to usual statistical measurement errors, some service sectors are dominated by large public firms where accounting may follow different criteria than those followed in the business sector. Some industries may be very small in some Member countries, possibly magnifying the aggregate impact of accounting or statistical in individual firms."* For example, Martins et al. (1996b) argue that high mark-ups in the Canadian Electricity, Gas & Water Supply sector are likely to be related to natural resource (ricardian) rents because a significant part of the electricity generation is based on cheap and abundant hydro-power. In this case, high mark-ups do not necessarily represent lower competition intensity of a highly regulated industry, but may instead reflect lower cost due to the important resource endowment. In other words, we know that we have to be very careful in the comparison of mark-ups, and particularly in a cross-country analysis. But many economists still consider mark-ups as one of the most reliable indicators of market power (e.g. Nickell, 1996). The obvious question is to ask what we can infer from the benchmarking of mark-ups in terms of competition intensity across countries.

Besides important differences in statistical and accounting procedures or resource endowment across countries, there is another important factor that can mislead the comparison of mark-ups across countries. In particular, a cross-country comparison of the Lerner index is problematic since we seldom know if it is variations in prices (i.e. market power) or costs (i.e. technical efficiency) that determines the estimate of the index.

In *Figure 5*, we have shown that the Lerner index has increased in almost all manufacturing industries in Canada between the period of 1981-1990 and 1991-2001. Also, we have shown that Canada's ranking increased over time compared to other

countries in the manufacturing sector (*Figure 10*). Does this mean that competition intensity has decreased in Canada over that period?

In section 3.2, we argued that a structural break appears to have occurred in many manufacturing industries at the beginning of the nineties. With the important reduction in trade costs for many Canadian manufacturing industries following the FTA & NAFTA agreements, we would expect competition intensity to increase (see Trefler, 2004). In other words, as the Canadian market becomes more open and trade costs are reduced, we would think that competition intensity would increase as more firms have access to the market. Companies in Canada compete with more competitors located in broader geographic areas.

However, we do not have sufficiently detailed information on the cost structure of industries across countries in order to test that claim. A higher (lower) mark-up of Canadian industries compared to the U.S. could simply mean lower (higher) cost or higher (lower) productivity. This is a particularly important issue for the international comparison of mark-ups because the benchmarking implicitly makes the assumption that the marginal costs are the same across countries. In light of the literature showing important and persistent productivity differences across countries, the likelihood that an industry's cost or productivity differs significantly between countries is high (for example see Bartelsman and Doms, 2000).

In addition, an increase of competition intensity in an industry could also be associated with higher mark-ups in the presence of sunk costs and heterogeneous (cost) firms. First, the industry's mark-up is usually estimated by calculating the weighted average of the Lerner index (PCM) where the weight is given by a firm's market share in the industry. Second, empirical evidence shows that competition tends to marginalize inefficient firms by reducing their output level.[11] Therefore, when competition intensity increases and output is reallocated to the most efficient firms in an industry, the weight of the most efficient firms in the industry increases and raises the Lerner index of the industry. When combined with the presence of (exogenous or endogenous) sunk costs, increased competition intensity and higher mark-ups can persist over time (see Sutton, 1991). Given the extensive empirical trade literature trade showing the importance of firm heterogeneity and sunk costs (see Greenaway and Kneller, 2007) these factors could explain the increase of the Lerner index in many Canadian manufacturing industries in the beginning of the nineties.

Finally, despite being more robust than the commonly used measure of competition such as the HHI, in many cases mark-ups are not monotonic in competition. For example, Boone (2000) shows that mark-ups can sometimes give an incorrect view of the degree of competition in a market. He proposes an alternative indicator based on the interaction between profits and efficiency (cost) called relative profit measure (RPM). More consistent with the theoretical predictions of game-theoretic models, the intuition behind the RPM is that in a more competitive market, marginally competitive firms are punished more harshly in terms of profit. In other words, if competition increases, the more

[11] For example, see Baldwin and Gu (2004), Schimtz (2005) and Syverson (2004a, 2004b).

efficient firms will gain more profits (or lower losses) than the less efficient firms in the market. The opposite should happen if competitive pressures are reduced. This approach has the advantage of taking costs into account and proves itself to be monotonic in competition intensity. Using simulated data, Boone et al. (2005) shows that in markets where goods are symmetrically differentiated and firms have different marginal cost, traditional measures of competition, such as the Lerner index, can be poor indicators of competition intensity while the RPM performs well. They then test the RPM empirically using UK firm-level data and compare it with the Lerner index. They find that RPM is generally positively correlated with the index both over time and across industries, but that there is a significant number of industries where it was not the case. This again suggests that we have to be careful in the interpretation of the Lerner index, as it may not be correlated with the intensity of competition.

5. Conclusion

According to several recent OECD studies, competition intensity appears to be relatively strong in Canada compared to other OECD countries. This claim is partly based on the benchmarking of mark-ups in (aggregated) industries across countries. This paper analyses the robustness of such an international benchmarking exercise using the models used by the OECD to estimate mark-ups.

Based on aggregated industry data, we find that such a benchmarking exercise is substantially influenced by sensitivities related to several underlying assumptions such as the time period selected, the level of (industry) aggregation and the rental price of capital. A simple statistical test shows large variations in the rankings of competitive intensity for Canada when compared to other countries. We then discuss several difficulties involved with the interpretation of the Lerner index in a cross-country setting such as the importance of persistent productivity differentials across countries, firms' cost heterogeneity within an industry, entry barriers created by sunk costs, and the non-monotonic relationship between mark-ups and the degree of intensity of competition.

In light of the aforementioned analysis and analysis, we conclude that competitive intensity estimated with Lerner indices obtained from models developed by Hall (1988) and Roeger (1995) offer rather unreliable evidence about the relative intensity of competition in an industry across countries and that they should be used, at best, with great caution to assess the intensity of competition in a country.

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TABLES AND FIGURES

Table 1: Lerner Index comparisons between our calculations (CP) and the OECD results, 1975-2002 *
(std. dev. in italics)

		CAN (0.98)		USA (0.98)		GBR (0.99)		FRA (0.99)		DEU (1.00)		FIN (1.00)		ITA (1.00)		BEL (1.00)		DNK (1.00)		ESP (1.00)	
Industry Name	ISIC 3	OECD	CP	OECD	CP	OECD	CP	OECD	CP	OECD	CP	OECD	CP	OECD	CP	OECD	CP	OECD	CP	OECD	CP
Manufacturing Industries																					
Textiles, Textile Products, Leather and Footwear	17-19	0.13	0.12	0.09	0.11	0.10	0.10	0.09	0.05	0.14	0.10	0.14	0.12	0.16	0.17	0.05		0.12	0.12	0.13	0.14
			0.01		*0.03*		*0.01*		*0.02*		*0.04*		*0.02*		*0.01*				*0.01*		*0.01*
Wood and Products of Wood and Cork	20	0.25	0.22	0.19	0.15	0.16	0.16	0.05		0.14	0.14	0.19	0.17	0.22	0.22	0.12	0.10	0.18	0.19	0.16	0.19
			0.02		*0.04*		*0.02*				*0.03*		*0.04*		*0.01*		*0.03*		*0.03*		*0.02*
Pulp, Paper, Paper Products, Printing and Publishing	21-22	0.20	0.20	0.13		0.12	0.12	0.13	0.13	0.19	0.24	0.23	0.20	0.18	0.18	0.14	0.13	0.10	0.10	0.18	0.17
			0.04				*0.02*		*0.01*		*0.06*		*0.03*		*0.01*		*0.02*		*0.02*		*0.02*
Other Non-metallic Mineral Products	26	0.22	0.22	0.17	0.24	0.16	0.16	0.16	0.12	0.19	0.15	0.24	0.22	0.22	0.23	0.17	0.15	0.17	0.17	0.19	0.21
			0.02		*0.07*		*0.02*		*0.03*		*0.05*		*0.03*		*0.01*		*0.02*		*0.02*		*0.02*
Fabricated Metal Products	28	0.13	0.13	0.12	0.10					0.07		0.16	0.17	0.19							
			0.02		*0.03*								*0.02*								
Food Products, Beverages and Tobacco	15-16	0.13	0.12	0.09	0.17	0.11	0.10	0.14	0.15	0.12	0.12	0.10	0.10	0.14	0.13	0.09	0.09	0.08	0.08	0.13	0.12
			0.01		*0.04*		*0.01*		*0.01*		*0.01*		*0.01*		*0.01*		*0.01*		*0.01*		*0.01*
Basic Metals	27	0.17	0.17	0.08						0.18	0.15	0.18	0.17	0.10							
			0.02								*0.04*		*0.02*								
Machinery and Equipment, NEC	29	0.16	0.18		0.18	0.12	0.13	0.19	0.23	0.13	0.13	0.17	0.17	0.15	0.16	0.20	0.21	0.09	0.09		0.15
			0.02		*0.04*		*0.02*		*0.02*		*0.03*		*0.02*		*0.01*		*0.07*		*0.02*		*0.03*
Manufacturing NEC; Recycling	36-37	0.08	0.09	0.10		0.13	0.12	0.13	0.13	0.16	0.12	0.17	0.18	0.17	0.18	0.06	0.06	0.15	0.14	0.15	0.18
			0.02				*0.01*		*0.02*		*0.03*		*0.02*		*0.01*		*0.02*		*0.02*		*0.02*
Chemical, Rubber, Plastics and Fuel Products	23-25	0.12	0.12	0.15		0.12	0.14	0.11	0.13	0.16	0.15	0.15	0.15	0.13	0.13	0.09	0.11	0.11	0.10	0.17	0.17
			0.03				*0.02*		*0.02*		*0.04*		*0.02*		*0.02*		*0.03*		*0.02*		*0.02*
Electrical and Optical Equipment	30-33	0.14	0.18			0.13	0.14	0.15	0.18	0.13		0.22	0.20	0.17	0.17			0.12	0.12		0.16
			0.04				*0.02*		*0.01*				*0.03*		*0.01*				*0.02*		*0.03*
Transport Equipment	34-35	0.13	0.11	0.10		0.07		0.11	0.08	0.09		0.17	0.16	0.14	0.10	0.09	0.09	0.08		0.11	0.08
			0.02						*0.02*				*0.04*		*0.01*		*0.02*				*0.02*
Non Manufacturing Industries																					
Electricity, Gas and Water Supply	40-41	0.35	0.65	0.20		0.15		0.27	0.33	0.37	0.39	0.37	0.42	0.30	0.25	0.23	0.19	0.41	0.42		0.54
			0.03						*0.02*		*0.09*		*0.04*		*0.05*		*0.06*		*0.04*		*0.07*
Wholesale and Retail Trade, Repairs	50-52	0.16	0.21	0.14	0.32	0.16		0.25	0.24	0.12	0.18	0.25	0.24	0.45	0.47			0.28	0.30		0.38
			0.02		*0.04*				*0.03*		*0.02*		*0.02*		*0.01*				*0.03*		*0.02*
Transport and Storage	60-63	0.26	0.25	0.16		0.10		0.22	0.20	0.13	0.25	0.33	0.31					0.19	0.16		
			0.02						*0.02*		*0.02*		*0.01*						*0.02*		
Post and Telecommunications	64	0.35	0.39	0.38		0.21		0.40	0.48	0.38	0.43	0.36	0.31					0.24	0.25		
			0.02						*0.07*		*0.06*		*0.05*						*0.04*		
Financial Intermediation	65-67	0.14	0.25	0.25	0.26	0.21	0.32	0.20	0.25	0.18		0.14	0.42	0.32	0.33		0.39	0.35	0.42		0.31
			0.03		*0.04*		*0.10*		*0.03*				*0.04*		*0.02*		*0.07*		*0.05*		*0.06*
Other Business Activities	74			0.20	0.16			0.29		0.44	0.40	0.19	0.16					0.20	0.21		
					0.02						*0.03*		*0.02*						*0.02*		

Note: OECD values taken from OECD (2005), Annex 1: Tables and Figures: Table 1.
Tax adjustment added from OECD (2005), Annex 2: Estimation of Mark Ups: Table A2.1; the adjustment is specified brackets after each country's name.
( ) refers to non-significant (at the 95% confidence level) or not available values.
* Period differs by country and industry (see Annex Table 1).

Table 2: Estimates of Lerner Index by Sector 1981-2001, Canada

ISIC3	Sector	81-01					
		Coefficient	Std Dev.	t-stat	p-value	R2	Nob
01-99	**Grand Total**	**0.226**	**0.008**	**27.359**	**0.000**	**0.974**	**21**
01-05	**Agriculture, Hunting, Forestry and Fishing**	**0.347**	**0.053**	**6.503**	**0.000**	**0.678**	**21**
01-02	Agriculture, Hunting and Forestry	0.340	0.055	6.207	0.000	0.657	21
05	Fishing	0.469	0.066	7.145	0.000	0.718	21
10-14	**Mining and Quarrying**	**0.772**	**0.055**	**14.144**	**0.000**	**0.909**	**21**
10-12	Mining and Quarrying of Energy Producing Materials	0.853	0.050	17.068	0.000	0.936	21
13-14	Mining and Quarrying Except Energy Producing Materials	0.587	0.049	12.040	0.000	0.878	21
15-37	**Total Manufacturing**	**0.137**	**0.016**	**8.408**	**0.000**	**0.765**	**21**
15-16	Food Products, Beverages and Tobacco	0.118	0.019	6.332	0.000	0.618	21
17-19	Textiles, Textile Products, Leather and Footwear	0.134	0.018	7.357	0.000	0.709	21
17-18	Textiles and Textile Products	0.136	0.019	7.281	0.000	0.700	21
17	Textiles	0.179	0.027	6.509	0.000	0.654	21
18	Wearing Apparel; Dressing and Dying of Fur	0.118	0.018	6.509	0.000	0.669	21
19	Leather, Leather Products and Footwear	0.148	0.040	3.731	0.001	0.408	21
20	Wood and Products of Wood and Cork	0.218	0.028	7.683	0.000	0.739	21
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.226	0.046	4.859	0.000	0.537	21
23-25	Chemical, Rubber, Plastics and Fuel Products	0.117	0.031	3.741	0.001	0.359	21
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.006	0.048	0.116	0.909	0.001	21
24	Chemicals and Chemical Products	0.223	0.033	6.729	0.000	0.678	21
24ex2423	Chemicals Excluding Pharmaceuticals	0.237	0.036	6.568	0.000	0.671	21
2423	Pharmaceuticals	0.253	0.052	4.835	0.000	0.528	21
25	Rubber and Plastics Products	0.131	0.026	4.978	0.000	0.495	21
26	Other Non-metallic Mineral Products	0.229	0.020	11.384	0.000	0.855	21
27-35	Basic Metals, Metal Products, Machinery and Equipment	0.136	0.021	6.510	0.000	0.674	21
27-28	Basic Metals and Fabricated Metal Products	0.154	0.022	7.140	0.000	0.714	21
27	Basic Metals	0.167	0.024	6.941	0.000	0.705	21
28	Fabricated Metal Products, Except Machinery and Equipment	0.136	0.024	5.770	0.000	0.611	21
29-33	Machinery and Equipment	0.166	0.027	6.057	0.000	0.645	21
29	Machinery and Equipment, n.e.c.	0.177	0.022	8.150	0.000	0.766	21
30-33	Electrical and Optical Equipment	0.182	0.036	5.121	0.000	0.559	21
34-35	Transport Equipment	0.114	0.027	4.281	0.000	0.447	21
34	Motor Vehicles, Trailers and Semi-trailers	0.134	0.027	4.916	0.000	0.523	21
35	Other Transport Equipment	0.160	0.073	2.191	0.041	0.186	21
351	Building and Repairing of Ships and Boats	0.138	0.089	1.547	0.138	0.104	21
353	Aircraft and Spacecraft	0.226	0.116	1.949	0.066	0.159	21
352+359	Railroad Equipment and Transport Equipment n.e.c.	0.210	0.046	4.572	0.000	0.510	21
36-37	Manufacturing nec; Recycling	0.088	0.030	2.935	0.008	0.251	21
40-41	**Electricity, Gas and Water Supply**	**0.670**	**0.046**	**14.556**	**0.000**	**0.913**	**21**
45	**Construction**	**0.095**	**0.010**	**9.630**	**0.000**	**0.814**	**21**
50-55	**Wholesale and Retail Trade; Restaurants and Hotels**	**0.201**	**0.017**	**11.975**	**0.000**	**0.877**	**21**
50-52	Wholesale and Retail Trade; Repairs	0.218	0.019	11.195	0.000	0.862	21
51	Wholesale Trade & Commission Excl. Motor Vehicles	0.138	0.029	4.784	0.000	0.499	21
55	Hotels and Restaurants	0.138	0.011	12.050	0.000	0.874	21
60-64	**Transport and Storage and Communication**	**0.286**	**0.019**	**15.464**	**0.000**	**0.923**	**21**
60-63	Transport and Storage	0.238	0.020	12.161	0.000	0.880	21
64	Post and Telecommunications	0.401	0.027	15.103	0.000	0.919	21
65-74	**Finance, Insurance, Real Estate and Business Services**	**0.475**	**0.022**	**21.120**	**0.000**	**0.957**	**21**
65-67	Financial Intermediation	0.248	0.026	9.430	0.000	0.815	21
70-74	Real Estate, Renting and Business Activities	0.592	0.031	18.873	0.000	0.947	21

Table 3: Lerner Index for Selected Industries With Tax Adjustment, 1981-2001

(with standard deviation in italics)

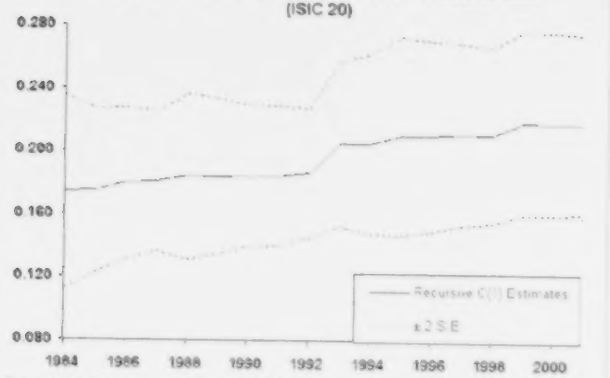
Industry Name	ISIC rev. 3	CAN (0.98)	FIN (1.00)	FRA (0.99)	GBR (0.99)	ITA (1.00)	NZL (1.00)	BEL (1.00)	ESP (1.00)	DNK (1.00)	Canada's Ranking
MANUFACTURING											
Food Products, Beverages and Tobacco	15-16	0.116	0.102	0.151	0.080	0.145	0.149	0.0119	0.122	0.051	5
		0.018	*0.017*	*0.022*	*0.012*	*0.021*	*0.024*	*0.013*	*0.013*	*0.015*	*(5-7)*
Textiles, Textile Products, Leather and Footwear	17-19	0.131	0.131	0.068	0.082	0.166	0.094		0.137	0.124	3
		0.020	*0.013*	*0.014*	*0.015*	*0.021*	*0.015*		*0.014*	*0.017*	*(3-5)*
Wood and Products of Wood and Cork	20	0.214	0.212		0.130	0.214		0.102	0.102	0.210	4
		0.028	*0.013*		*0.019*	*0.029*		*0.038*	*0.025*	*0.027*	*(3-5)*
Pulp, Paper, Paper Products, Printing and Publishing	21-22	0.221	0.230	0.126	0.110	0.154		0.160	0.167	0.036	3
		0.040	*0.020*	*0.014*	*0.014*	*0.022*		*0.023*	*0.020*	*0.023*	*(1-3)*
Coke, Refined Petroleum Products and Nuclear Fuel	23		0.111	0.104							
			0.049	*0.035*							
Chemicals and Chemical Products	24	0.216	0.202		0.141	0.116		0.262		0.212	2
		0.031	*0.020*		*0.022*	*0.022*		*0.040*		*0.032*	*(1-2)*
Other Non-metallic Mineral Products	26	0.174	0.164	0.178	0.158	0.136	0.166	0.175	0.171	0.150	4
		0.020	*0.031*	*0.047*	*0.023*	*0.027*	*0.032*	*0.030*	*0.027*	*0.029*	*(3)*
Basic Metals and Fabricated Metal Products	27-28	0.151	0.159	0.082	0.057	0.114	0.146	0.135	0.119	0.116	2
		0.013	*0.010*	*0.014*	*0.010*	*0.008*	*0.015*	*0.010*	*0.010*	*0.011*	*(1-2)*
Machinery and Equipment, n.e.c.	29	0.173	0.161	0.209	0.130	0.170				0.093	5
		0.011	*0.028*	*0.013*	*0.017*	*0.007*				*0.024*	*(4)*
Electrical and Optical Equipment	30-33	0.176	0.239	0.147	0.113	0.174				0.109	3
		0.010	*0.025*	*0.012*	*0.007*	*0.005*				*0.009*	*(4)*
Transport Equipment	34-35	0.111		0.080		0.079		0.103	0.051		5
		0.020		*0.033*		*0.008*		*0.019*	*0.031*		*(5)*
Manufacturing nec; Recycling	36-37	0.087	0.178	0.165	0.111	0.184	0.153		0.161	0.153	6
		0.018	*0.023*	*0.020*	*0.012*	*0.008*	*0.021*		*0.020*	*0.023*	*(7)*
NON MANUFACTURING											
Agriculture, Hunting, Forestry and Fishing	01-05	0.380	0.411	0.476		0.430	0.383			0.315	4
		0.052	*0.040*	*0.031*		*0.032*	*0.033*			*0.050*	*(4-6)*
Mining and Quarrying	10-14	0.787	0.241			0.670	0.356			0.677	2
		0.054	*0.005*			*0.023*	*0.035*			*0.046*	
Electricity, Gas and Water Supply	40-41	0.567	0.434	0.340		0.692	0.336			0.430	1
		0.041	*0.044*	*0.030*		*0.031*	*0.035*			*0.055*	
Construction	45	0.093	0.139	0.116		0.269	0.149				6
		0.010	*0.013*	*0.014*		*0.005*	*0.014*				
Wholesale and Retail Trade, Repairs	50-52	0.313	0.266	0.233		0.477				0.160	4
		0.018	*0.020*	*0.038*		*0.007*				*0.018*	
Hotels and Restaurants	55	0.136	0.086	0.272		0.308				0.216	1
		0.011	*0.010*	*0.024*		*0.005*				*0.026*	
Transport and Storage	60-63	0.354	0.320	0.309			0.184			0.131	1
		0.018	*0.018*	*0.021*			*0.025*			*0.020*	
Post and Telecommunications	64	0.360	0.372	0.467			0.340			0.230	2
		0.026	*0.027*	*0.105*			*0.054*			*0.035*	*(3)*

*Possible Ranking for Canada, specified in brackets under the regular ranking, was obtained by adding and subtracting one standard error to Canada's Lerner index value and then comparing those values with the regular Lerner indices of other countries. For example, in the food product industry, if we add the standard error to Canada's Lerner index value and compares it to the regular values of the other countries, Canada would be ranked 1st, if one subtracts a standard error from the Lerner index and compares, Canada would be ranked 7th.

Note: Tax adjustment added from OECD (2005), Annex 2, Estimation of Mark-Ups, Table A2.1, the adjustment is specified brackets after each country's name. New Zealand is the only exception and it is assumed to need no tax adjustment.

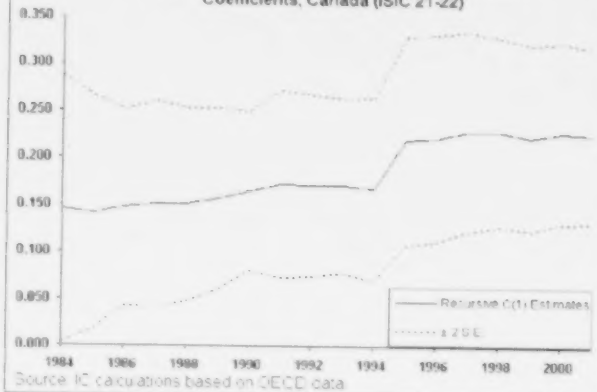
( ) refers to not available or not significant (at the 95% confidence level) values

Fig.1: Wood Products Recursive Coefficients, Canada (ISIC 20)



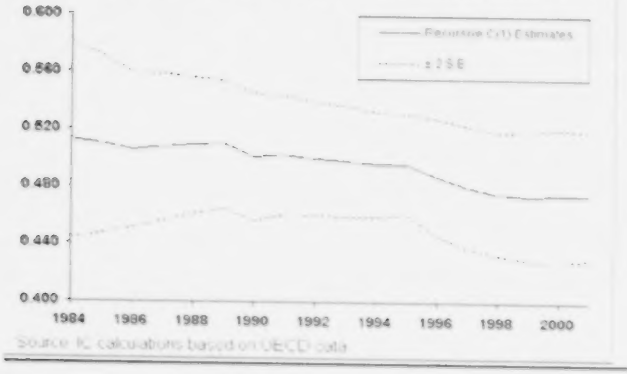
Source: IC calculations based on OECD data

Fig. 2: Pulp, Paper and Paper Products Recursive Coefficients, Canada (ISIC 21-22)



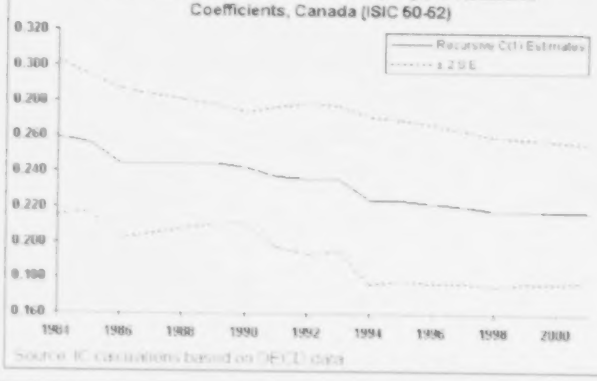
Source: IC calculations based on OECD data

Fig. 3: FIRE Recursive Coefficients, Canada (ISIC 65-74)



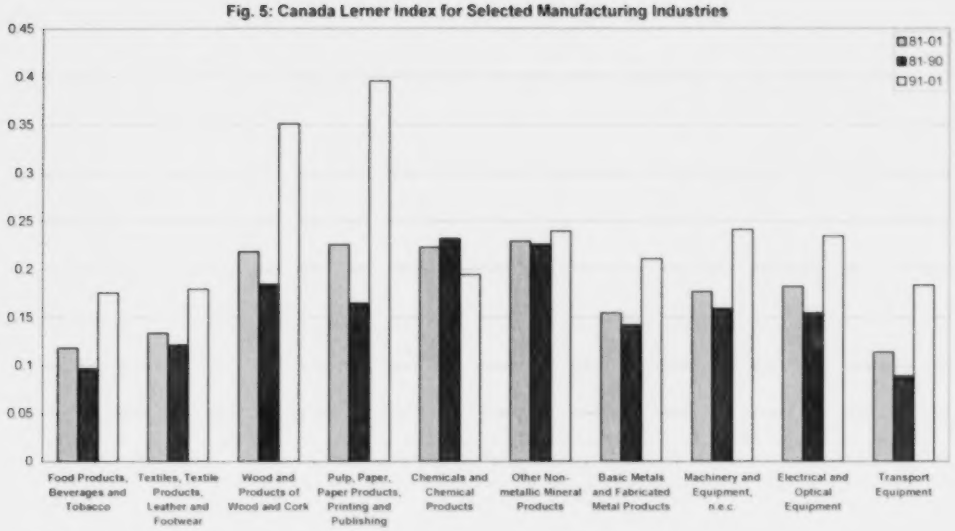
Source: IC calculations based on OECD data

Fig. 4: Wholesale and Retail Trade; Repairs Recursive Coefficients, Canada (ISIC 50-52)



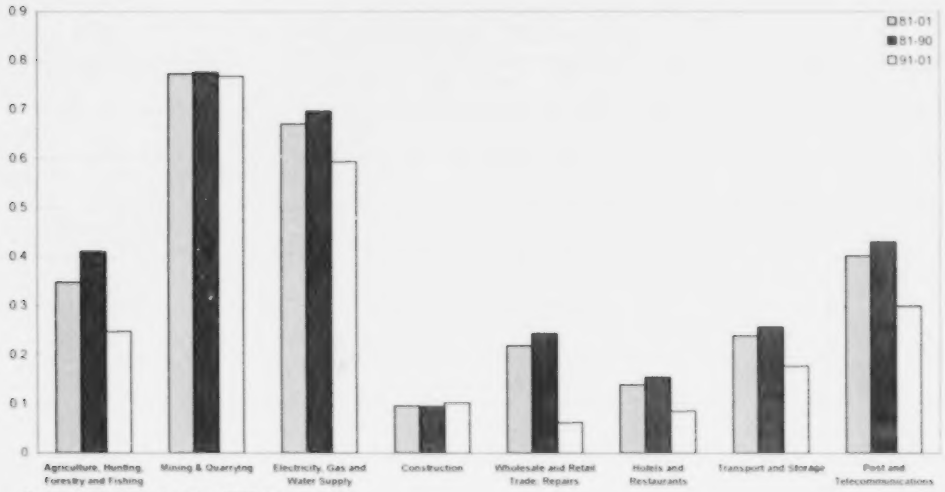
Source: IC calculations based on OECD data

Fig. 5: Canada Lerner Index for Selected Manufacturing Industries



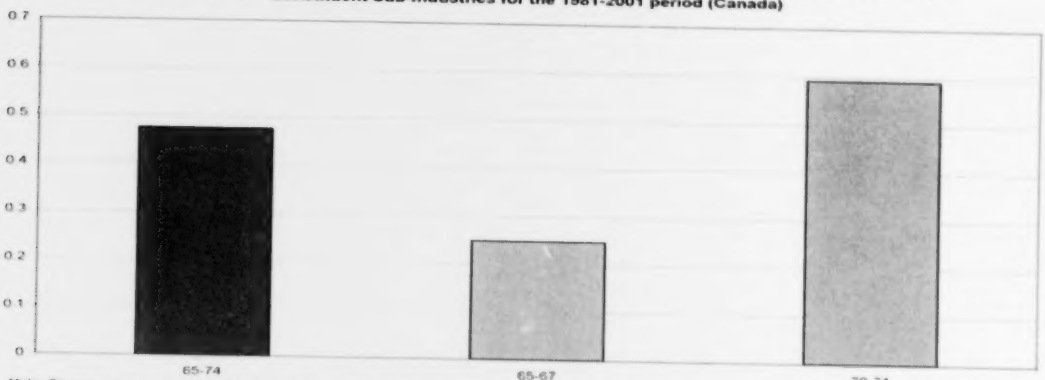
Source: IC calculations based on OECD data

Fig. 6: Canada Lerner Index for Selected Non-Manufacturing Industries



Source: IC calculations based on OECD data

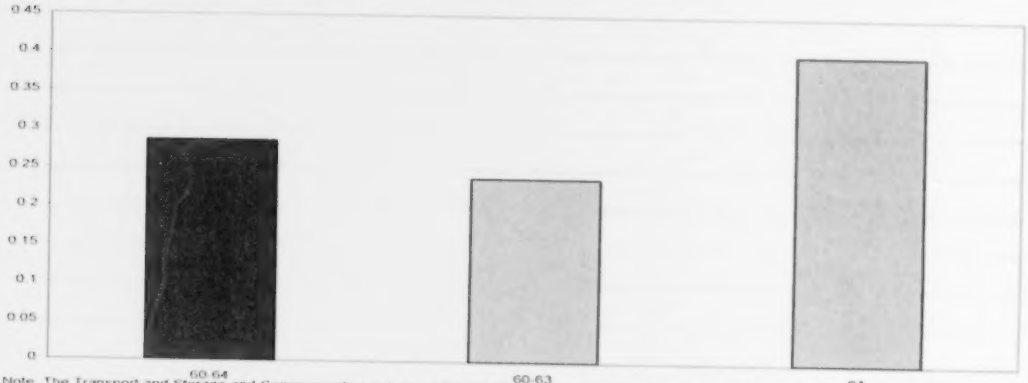
Fig. 7: Lerner Index in the Finance, Insurance, Real Estate and Business Services Industry, and its Constituent Sub-Industries for the 1981-2001 period (Canada)



Note: Finance, Insurance, Real Estate and Business Services industry (ISIC 65-74) comprises of the Financial Intermediation industry (ISIC 65-67) and of the Real Estate, Renting and Business Activities industry (ISIC 70-74).

Source: IC calculations based on OECD data.

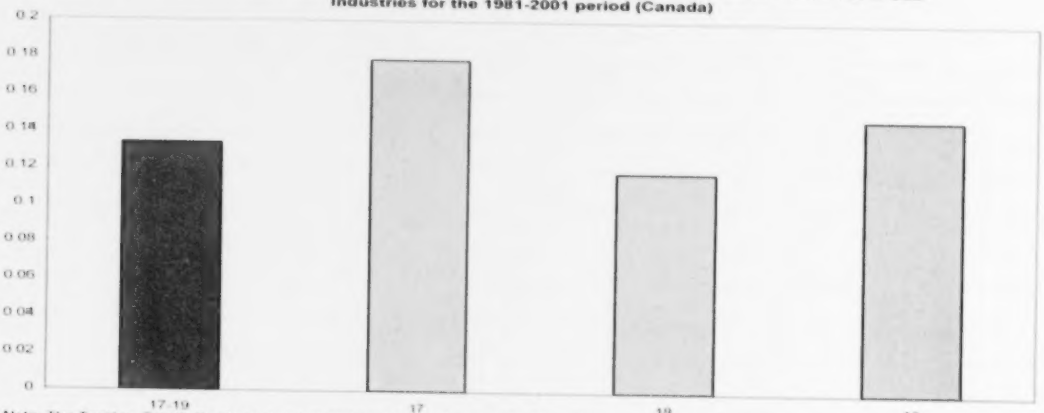
Fig. 8: Lerner Index in the Transport, Storage and Communications Industry, and its Constituent Sub-Industries for the 1981-2001 period (Canada)



Note: The Transport and Storage and Communication industry (ISIC 60-64) is comprised of the Transport and Storage (ISIC 60-63) and Post and Telecommunications (ISIC 64) industries.

Source: IC calculations based on OECD data.

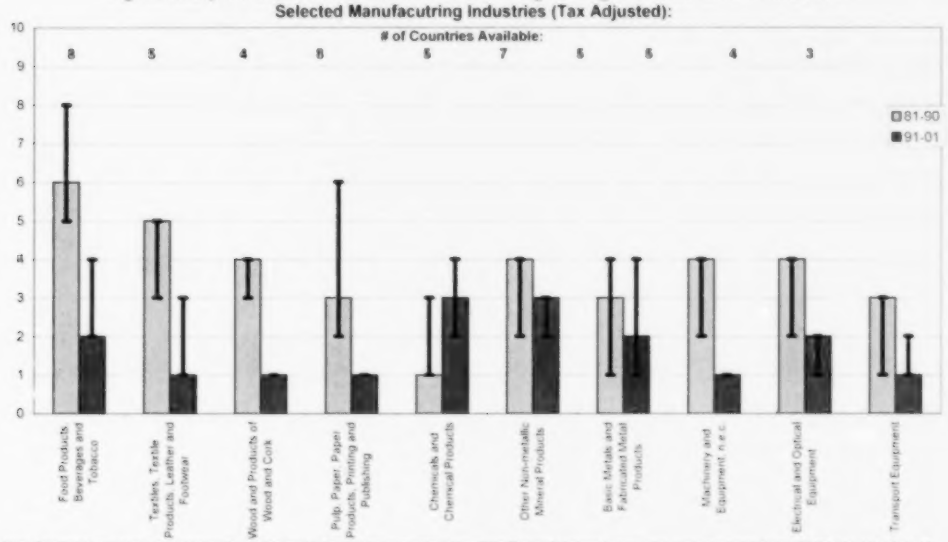
Fig. 9: Lerner Index in the Textile and Leather Manufacturing Industry, and its Constituent Sub-Industries for the 1981-2001 period (Canada)



Note: The Textiles, Textile Products, Leather and Footwear industry (ISIC 17-19) comprises of the Textiles (ISIC 17), Wearing Apparel, Dressing and Dying of Fur (ISIC 18) and Leather, Leather Products and Footwear (ISIC 19) industries.

Source: IC calculations based on OECD data.

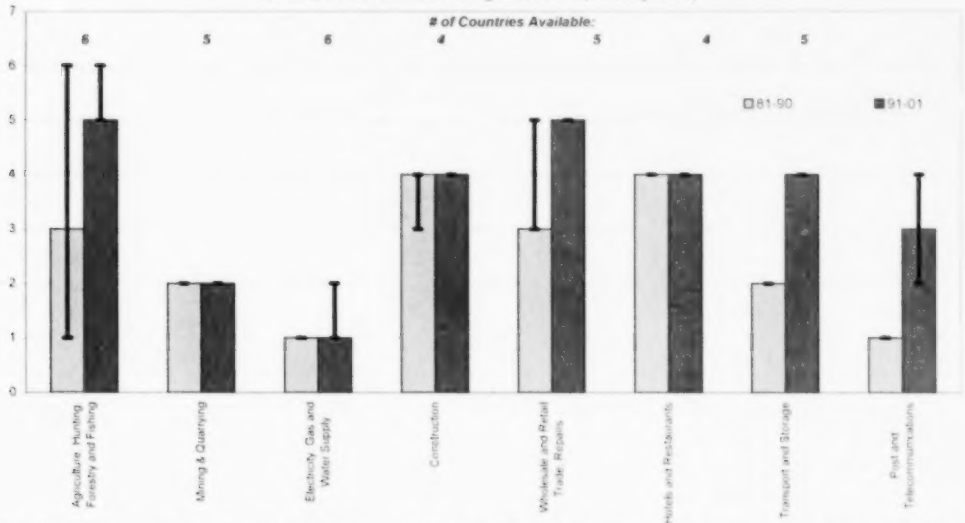
Fig. 10: Comparison of Canadian Lerner Index Ranking Among Selected OECD Countries for Selected Manufacutring Industries (Tax Adjusted):



Note: Standard error bars were obtained by adding and subtracting one standard error from Canada's Lerner Index value, and comparing them with the regular values of the other countries. For example, in the food product industry for the 1981-1990 period, if one adds a standard error to Canada's Lerner Index value and compares it to the regular values of the other countries, Canada would be ranked 5th. If one subtracts a standard error from the Lerner Index and compares, Canada would be ranked 8th. Tax adjustments were obtained from OECD (2005), Annex 2: Estimation of Mark Ups: Table A2.1

Only countries which had significant Lerner Index values for both time periods were used in this comparison.
Source: IC calculations based on OECD data.

Fig. 11: Comparison of Canadian Lerner Index Ranking Among Selected OECD Countries for Selected Non- Manufacutring Industries (Tax Adjusted):



Note: Standard error bars were obtained by adding and subtracting one standard error from Canada's Lerner index value, and comparing them with the regular values of the other countries. Tax adjustments were obtained from OECD (2005), Annex 2: Estimation of Mark Ups: Table A2.1

Only countries which had significant Lerner Index values for both time periods were used in this comparison.
Source: IC calculations based on OECD data.

ANNEX

Table A.1. Estimation of Lerner Index by Sector and Country

	ISIC 3	Sector	Coefficient	Std. Dev.	T-stat	p-value	R2	Nob	Period
Canada	17-19	Textiles, Textile Products, Leather and Footwear	0.119	0.015	8.005	0.000	0.704	27	75-01
	20	Wood and Products of Wood and Cork	0.223	0.021	10.479	0.000	0.808	27	75-01
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.201	0.042	4.757	0.000	0.465	27	75-01
	26	Other Non-metallic Mineral Products	0.223	0.016	13.870	0.000	0.881	27	75-01
	28	... Fabricated Metal Products	0.135	0.025	5.319	0.000	0.569	21	81-01
	15-16	Food Products, Beverages and Tobacco	0.123	0.014	8.849	0.000	0.748	27	75-01
	27	... Basic Metals	0.173	0.025	6.955	0.000	0.707	21	81-01
	29	... Machinery and Equipment, NEC	0.183	0.023	8.041	0.000	0.760	21	81-01
	36-37	Manufacturing NEC; Recycling	0.089	0.024	3.614	0.001	0.327	27	75-01
	23-25	Chemical, Rubber, Plastics and Fuel Products	0.120	0.026	4.619	0.000	0.445	27	75-01
	30-33	... Electrical and Optical Equipment	0.184	0.037	5.012	0.000	0.549	21	81-01
	34-35	Transport Equipment	0.111	0.017	6.577	0.000	0.624	27	75-01
	40-41	Electricity, Gas and Water Supply	0.658	0.035	18.759	0.000	0.931	27	75-01
	50-52	Wholesale and Retail Trade; Repairs	0.214	0.021	10.328	0.000	0.842	21	81-01
	60-63	Transport and Storage	0.253	0.019	13.021	0.000	0.893	21	81-01
	64	Post and Telecommunications	0.400	0.025	15.852	0.000	0.926	21	81-01
	65-67	Financial Intermediation	0.258	0.026	9.863	0.000	0.829	21	81-01
USA			coefficient	Std. Dev.	T-stat	p-value	R2	Nob	Period
	17-19	Textiles, Textile Products, Leather and Footwear	0.112	0.032	3.494	0.004	0.427	15	88-02
	20	Wood and Products of Wood and Cork	0.158	0.038	4.122	0.001	0.533	15	88-02
	26	Other Non-metallic Mineral Products	0.247	0.070	3.514	0.003	0.399	15	88-02
	28	... Fabricated Metal Products	0.104	0.032	3.241	0.006	0.423	15	88-02
	15-16	Food Products, Beverages and Tobacco	0.172	0.037	4.646	0.000	0.577	15	88-02
	27	... Basic Metals	0.055	0.050	1.106	0.287	0.050	15	88-02
	29	... Machinery and Equipment, NEC	0.186	0.044	4.206	0.001	0.557	15	88-02
	50-52	Wholesale and Retail Trade; Repairs	0.325	0.037	8.865	0.000	0.826	15	88-02
	65-67	Financial Intermediation	0.261	0.046	5.712	0.000	0.657	15	88-02
	74	..... Other Business Activities	0.165	0.018	9.062	0.000	0.837	15	88-02
Great Britain			coefficient	Std. Dev.	T-stat	p-value	R2	Nob	Period
	17-19	Textiles, Textile Products, Leather and Footwear	0.103	0.012	8.299	0.000	0.715	28	75-02
	20	Wood and Products of Wood and Cork	0.157	0.018	8.676	0.000	0.736	28	75-02
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.122	0.018	6.755	0.000	0.628	28	75-02
	26	Other Non-metallic Mineral Products	0.163	0.019	8.359	0.000	0.718	28	75-02
	15-16	Food Products, Beverages and Tobacco	0.103	0.011	9.494	0.000	0.769	28	75-02
	29	... Machinery and Equipment, NEC	0.136	0.021	6.463	0.000	0.662	22	81-02
	36-37	Manufacturing NEC; Recycling	0.121	0.010	11.884	0.000	0.839	28	75-02
	23-25	Chemical, Rubber, Plastics and Fuel Products	0.146	0.024	6.006	0.000	0.564	28	75-02
	30-33	... Electrical and Optical Equipment	0.146	0.021	7.095	0.000	0.705	22	81-02
	34-35	Transport Equipment	0.045	0.031	1.467	0.154	0.072	28	75-02
	40-41	Electricity, Gas and Water Supply	0.168	0.117	1.437	0.176	0.143	13	90-02
	65-67	Financial Intermediation	0.321	0.105	3.071	0.010	0.427	13	90-02
France			coefficient	Std. Dev.	T-stat	p-value	R2	Nob	Period
	17-19	Textiles, Textile Products, Leather and Footwear	0.064	0.016	3.944	0.001	0.363	28	75-02
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.134	0.010	13.078	0.000	0.856	28	75-02
	26	Other Non-metallic Mineral Products	0.123	0.031	4.000	0.000	0.357	28	75-02
	15-16	Food Products, Beverages and Tobacco	0.156	0.015	10.668	0.000	0.796	28	75-02
	29	... Machinery and Equipment, NEC	0.231	0.018	13.023	0.000	0.853	24	79-02
	36-37	Manufacturing NEC; Recycling	0.129	0.016	7.933	0.000	0.697	28	75-02
	23-25	Chemical, Rubber, Plastics and Fuel Products	0.127	0.017	7.320	0.000	0.634	28	75-02
	30-33	... Electrical and Optical Equipment	0.177	0.013	13.360	0.000	0.862	24	79-02
	34-35	Transport Equipment	0.085	0.023	3.643	0.001	0.300	28	75-02
	40-41	Electricity, Gas and Water Supply	0.333	0.023	14.565	0.000	0.895	25	78-02
	50-52	Wholesale and Retail Trade; Repairs	0.242	0.026	9.267	0.000	0.786	24	79-02
	60-63	Transport and Storage	0.200	0.017	11.784	0.000	0.857	24	79-02
	64	Post and Telecommunications	0.484	0.073	6.599	0.000	0.646	24	79-02
	65-67	Financial Intermediation	0.248	0.035	7.134	0.000	0.681	24	79-02
Germany			coefficient	Std. Dev.	T-stat	p-value	R2	Nob	Period
	17-19	Textiles, Textile Products, Leather and Footwear	0.104	0.041	2.529	0.030	0.379	11	92-02
	20	Wood and Products of Wood and Cork	0.143	0.031	4.591	0.001	0.499	11	92-02
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.242	0.059	4.101	0.002	0.522	11	92-02
	26	Other Non-metallic Mineral Products	0.151	0.046	3.326	0.008	0.470	11	92-02
	28	... Fabricated Metal Products	0.097	0.055	1.770	0.107	0.152	11	92-02
	15-16	Food Products, Beverages and Tobacco	0.121	0.007	17.235	0.000	0.964	12	91-02
	27	... Basic Metals	0.153	0.039	3.881	0.003	0.563	11	92-02

Table A.1. Continued

	ISIC.3		coefficient	Std. Dev	T-stat	p-value	R2	Nob	Period
Finland	17-19	Textiles, Textile Products, Leather and Footwear	0.123	0.016	7.451	0.000	0.672	27	76-02
	20	Wood and Products of Wood and Cork	0.173	0.043	4.027	0.000	0.384	27	76-02
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.198	0.032	6.273	0.000	0.602	27	76-02
	26	Other Non-metallic Mineral Products	0.219	0.028	7.936	0.000	0.695	27	76-02
	28	...Fabricated Metal Products	0.165	0.017	9.810	0.000	0.778	27	76-02
	15-16	Food Products, Beverages and Tobacco	0.098	0.013	7.253	0.000	0.643	27	76-02
	27	...Basic Metals	0.166	0.021	7.912	0.000	0.705	27	76-02
	29	...Machinery and Equipment, NEC	0.166	0.022	7.616	0.000	0.678	27	76-02
	36-37	Manufacturing NEC; Recycling	0.178	0.020	8.840	0.000	0.721	27	76-02
	23-25	Chemical, Rubber, Plastics and Fuel Products	0.153	0.024	6.356	0.000	0.586	27	76-02
	30-33	...Electrical and Optical Equipment	0.203	0.030	6.751	0.000	0.637	27	76-02
	34-35	Transport Equipment	0.159	0.044	3.604	0.001	0.323	27	76-02
	40-41	Electricity, Gas and Water Supply	0.422	0.044	9.550	0.000	0.766	27	76-02
	50-52	Wholesale and Retail Trade; Repairs	0.244	0.016	14.869	0.000	0.893	27	76-02
	60-63	Transport and Storage	0.313	0.014	21.825	0.000	0.948	27	76-02
	64	Post and Telecommunications	0.309	0.045	6.830	0.000	0.634	27	76-02
	65-67	Financial Intermediation	0.417	0.043	9.696	0.000	0.783	27	76-02
	74	.....Other Business Activities	0.164	0.024	6.787	0.000	0.639	27	76-02
Italy			coefficient	Std. Dev	T-stat	p-value	R2	Nob	Period
	17-19	Textiles, Textile Products, Leather and Footwear	0.173	0.005	31.566	0.000	0.980	21	81-01
	20	Wood and Products of Wood and Cork	0.222	0.009	24.594	0.000	0.968	21	81-01
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.178	0.012	15.110	0.000	0.918	21	81-01
	26	Other Non-metallic Mineral Products	0.231	0.013	17.117	0.000	0.934	21	81-01
	15-16	Food Products, Beverages and Tobacco	0.134	0.005	24.444	0.000	0.967	21	81-01
	29	...Machinery and Equipment, NEC	0.162	0.008	20.074	0.000	0.951	21	81-01
	36-37	Manufacturing NEC; Recycling	0.177	0.008	23.007	0.000	0.963	21	81-01
	23-25	Chemical, Rubber, Plastics and Fuel Products	0.132	0.017	8.020	0.000	0.762	21	81-01
	30-33	...Electrical and Optical Equipment	0.173	0.009	19.171	0.000	0.944	21	81-01
	34-35	Transport Equipment	0.104	0.013	8.043	0.000	0.763	21	81-01
	40-41	Electricity, Gas and Water Supply	0.248	0.047	5.238	0.000	0.556	21	81-01
	50-52	Wholesale and Retail Trade; Repairs	0.470	0.011	41.728	0.000	0.988	21	81-01
	65-67	Financial Intermediation	0.326	0.025	13.301	0.000	0.898	21	81-01
Belgium			coefficient	Std. Dev	T-stat	p-value	R2	Nob	Period
	17-19	Textiles, Textile Products, Leather and Footwear	0.038	0.019	2.023	0.053	0.122	28	75-02
	20	Wood and Products of Wood and Cork	0.105	0.027	3.832	0.001	0.350	28	75-02
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.134	0.021	6.511	0.000	0.594	28	75-02
	26	Other Non-metallic Mineral Products	0.154	0.024	6.538	0.000	0.613	28	75-02
	15-16	Food Products, Beverages and Tobacco	0.086	0.014	6.256	0.000	0.580	28	75-02
	29	...Machinery and Equipment, NEC	0.210	0.074	2.850	0.029	0.530	7	96-02
	36-37	Manufacturing NEC; Recycling	0.063	0.023	2.691	0.012	0.212	28	75-02
	23-25	Chemical, Rubber, Plastics and Fuel Products	0.105	0.031	3.352	0.002	0.285	28	75-02
	30-33	...Electrical and Optical Equipment	0.052	0.075	0.696	0.512	0.007	7	96-02
	34-35	Transport Equipment	0.091	0.018	5.023	0.000	0.480	28	75-02
	40-41	Electricity, Gas and Water Supply	0.195	0.064	3.038	0.023	0.595	7	96-02
	50-52	Wholesale and Retail Trade; Repairs	0.074	0.035	2.144	0.076	0.426	7	96-02
	65-67	Financial Intermediation	0.388	0.072	5.431	0.002	0.828	7	96-02
Denmark			coefficient	Std. Dev	T-stat	p-value	R2	Nob	Period
	17-19	Textiles, Textile Products, Leather and Footwear	0.123	0.014	8.957	0.000	0.748	28	75-02
	20	Wood and Products of Wood and Cork	0.186	0.026	7.094	0.000	0.650	28	75-02
	21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.098	0.017	5.699	0.000	0.542	28	75-02
	26	Other Non-metallic Mineral Products	0.172	0.022	7.842	0.000	0.691	28	75-02
	15-16	Food Products, Beverages and Tobacco	0.085	0.012	7.195	0.000	0.657	28	75-02
	29	...Machinery and Equipment, NEC	0.092	0.023	4.028	0.000	0.375	28	75-02
	36-37	Manufacturing NEC; Recycling	0.145	0.017	8.294	0.000	0.717	28	75-02
	23-25	Chemical, Rubber, Plastics and Fuel Products	0.100	0.024	4.128	0.000	0.365	28	75-02
	30-33	...Electrical and Optical Equipment	0.121	0.024	5.065	0.000	0.482	28	75-02
	34-35	Transport Equipment	0.069	0.043	1.611	0.119	0.087	28	75-02
	40-41	Electricity, Gas and Water Supply	0.421	0.045	9.397	0.000	0.765	28	75-02
	50-52	Wholesale and Retail Trade; Repairs	0.302	0.027	11.037	0.000	0.818	28	75-02
	60-63	Transport and Storage	0.159	0.019	8.191	0.000	0.713	28	75-02
	64	Post and Telecommunications	0.249	0.039	6.369	0.000	0.593	28	75-02
	65-67	Financial Intermediation	0.423	0.048	8.809	0.000	0.742	28	75-02
	74	.....Other Business Activities	0.208	0.023	9.198	0.000	0.758	28	75-02

Table A.2: Lerner Index for Selected OECD countries and Industries, 1981-2001, 1981-1990 and 1991-2001

Canada		81-01					81-90					91-01				
ISIC 3	Industry Name	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.118	0.019	6.332	0.000	0.618	0.097	0.018	5.263	0.001	0.753	0.175	0.036	4.884	0.001	0.563
17-19	Textiles, Textile Products, Leather and Footwear	0.134	0.018	7.357	0.000	0.709	0.121	0.023	5.214	0.001	0.751	0.179	0.032	5.570	0.000	0.619
20	Wood and Products of Wood and Cork	0.218	0.028	7.693	0.000	0.739	0.186	0.022	8.221	0.000	0.882	0.351	0.063	5.555	0.000	0.711
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.226	0.045	4.899	0.000	0.537	0.165	0.042	3.900	0.004	0.608	0.395	0.089	4.433	0.001	0.623
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.006	0.049	0.116	0.909	0.001	-0.009	0.082	-0.113	0.913	-0.027	0.015	0.060	0.249	0.808	-0.030
24	Chemicals and Chemical Products	0.223	0.033	6.729	0.000	0.678	0.232	0.041	5.605	0.000	0.776	0.194	0.064	3.037	0.013	0.309
26	Other Non-metallic Mineral Products	0.229	0.020	11.384	0.000	0.856	0.226	0.023	9.772	0.000	0.913	0.239	0.042	5.662	0.000	0.656
27-28	Basic Metals and Fabricated Metal Products	0.154	0.022	7.140	0.000	0.714	0.142	0.024	5.825	0.000	0.795	0.211	0.049	4.313	0.002	0.551
29	Machinery and Equipment, n.e.c.	0.177	0.022	8.150	0.000	0.766	0.158	0.025	6.367	0.000	0.804	0.241	0.042	5.677	0.000	0.676
30-33	Electrical and Optical Equipment	0.182	0.036	5.121	0.000	0.559	0.154	0.028	5.575	0.000	0.755	0.234	0.075	3.140	0.011	0.496
34-35	Transport Equipment	0.114	0.027	4.281	0.000	0.447	0.089	0.027	3.232	0.010	0.532	0.183	0.053	3.456	0.006	0.468
36-37	Manufacturing nec; Recycling	0.088	0.030	2.935	0.008	0.251	0.060	0.039	1.539	0.152	0.208	0.165	0.047	3.505	0.006	0.419
01-05	**Agriculture, Hunting, Forestry and Fishing**	**0.347**	**0.053**	**6.503**	**0.000**	**0.670**	**0.409**	**0.077**	**5.308**	**0.001**	**0.752**	**0.247**	**0.068**	**3.625**	**0.005**	**0.472**
10-14	**Mining and Quarrying**	**0.777**	**0.055**	**14.114**	**0.000**	**0.909**	**0.775**	**0.078**	**9.896**	**0.000**	**0.899**	**0.767**	**0.081**	**9.437**	**0.000**	**0.905**
40-41	**Electricity, Gas and Water Supply**	**0.670**	**0.046**	**14.556**	**0.000**	**0.913**	**0.695**	**0.053**	**13.228**	**0.000**	**0.949**	**0.593**	**0.094**	**6.341**	**0.000**	**0.717**
45	**Construction**	**0.095**	**0.010**	**9.630**	**0.000**	**0.814**	**0.094**	**0.015**	**6.149**	**0.000**	**0.777**	**0.102**	**0.017**	**6.041**	**0.000**	**0.881**
50-52	Wholesale and Retail Trade, Repairs	0.218	0.019	11.196	0.000	0.862	0.242	0.016	15.330	0.000	0.962	0.051	0.036	1.747	0.117	0.157
55	Hotels and Restaurants	0.138	0.011	12.060	0.000	0.874	0.154	0.009	16.826	0.000	0.963	0.085	0.023	3.675	0.004	0.547
60-63	Transport and Storage	0.298	0.020	12.161	0.000	0.880	0.256	0.026	9.670	0.000	0.910	0.177	0.026	6.898	0.000	0.649
64	Post and Telecommunications	0.401	0.027	15.100	0.000	0.919	0.429	0.025	16.909	0.000	0.969	0.299	0.056	5.344	0.000	0.719
USA				81-01					81-90					91-01		
ISIC 3	Industry Name	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco											0.190	0.042	4.566	0.001	0.634
17-19	Textiles, Textile Products, Leather and Footwear											0.098	0.021	4.641	0.001	0.673
20	Wood and Products of Wood and Cork											0.134	0.037	3.629	0.006	0.562
23	Coke, Refined Petroleum Products and Nuclear Fuel											0.306	0.053	6.172	0.000	0.791
24	Chemicals and Chemical Products											0.193	0.039	4.985	0.001	0.692
26	Other Non-metallic Mineral Products											0.242	0.089	2.726	0.021	0.265
27-28	Basic Metals and Fabricated Metal Products											0.064	0.030	2.104	0.062	0.167
29	Machinery and Equipment, n.e.c.											0.201	0.045	4.507	0.001	0.670
45	**Construction**											**0.172**	**0.029**	**6.077**	**0.000**	**0.861**
50-52	Wholesale and Retail Trade, Repairs											0.304	0.041	7.369	0.000	0.787
55	Hotels and Restaurants											0.188	0.020	9.520	0.000	0.961
Germany				81-01					81-90					91-01		
ISIC 3	Industry Name	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco											0.120	0.005	23.780	0.000	0.982
01-05	**Agriculture, Hunting, Forestry and Fishing**											**0.232**	**0.011**	**20.466**	**0.000**	**0.977**
10-14	**Mining and Quarrying**											**0.252**	**0.205**	**1.231**	**0.247**	**0.036**
50-52	Wholesale and Retail Trade, Repairs											0.174	0.017	10.486	0.000	0.947
60-63	Transport and Storage											0.214	0.023	9.303	0.000	0.934
Finland				81-01					81-90					91-01		
ISIC 3	Industry Name	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2	Coefficient	Std.Dev.	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.102	0.017	5.941	0.000	0.614	0.088	0.019	4.720	0.001	0.651	0.141	0.030	4.682	0.002	0.612
17-19	Textiles, Textile Products, Leather and Footwear	0.131	0.021	6.162	0.000	0.652	0.120	0.024	5.068	0.001	0.507	0.151	0.040	3.802	0.004	0.400
20	Wood and Products of Wood and Cork	0.213	0.043	4.974	0.000	0.550	0.169	0.060	2.788	0.004	0.525	0.238	0.071	3.358	0.007	0.526
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.230	0.035	6.476	0.000	0.677	0.178	0.039	4.577	0.001	0.688	0.290	0.056	5.174	0.000	0.671
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.111	0.060	2.376	0.034	0.179	0.113	0.059	2.536	0.017	0.338	0.105	0.106	0.994	0.346	0.086
24	Chemicals and Chemical Products	0.202	0.006	5.036	0.000	0.638	0.204	0.004	6.006	0.000	0.730	0.198	0.073	2.727	0.021	0.387
26	Other Non-metallic Mineral Products	0.264	0.031	8.263	0.000	0.789	0.269	0.045	6.023	0.000	0.783	0.236	0.044	5.329	0.000	0.731
27-28	Basic Metals and Fabricated Metal Products	0.169	0.023	6.937	0.000	0.706	0.157	0.033	4.755	0.001	0.677	0.162	0.034	4.779	0.001	0.648
29	Machinery and Equipment, n.e.c.	0.161	0.026	6.246	0.000	0.690	0.163	0.047	3.411	0.009	0.508	0.160	0.030	5.335	0.000	0.775
30-33	Electrical and Optical Equipment	0.229	0.035	6.579	0.000	0.700	0.210	0.051	4.139	0.000	0.651	0.255	0.049	5.229	0.000	0.715
34-35	Transport Equipment	0.095	0.064	1.488	0.092	0.135	0.069	0.098	0.702	0.501	0.049	0.127	0.049	2.568	0.027	0.399
36-37	Manufacturing nec; Recycling	0.178	0.023	7.787	0.000	0.737	0.195	0.032	6.006	0.000	0.860	0.151	0.041	3.665	0.004	0.573
01-05	**Agriculture, Hunting, Forestry and Fishing**	**0.411**	**0.040**	**10.208**	**0.000**	**0.835**	**0.334**	**0.038**	**8.764**	**0.000**	**0.776**	**0.524**	**0.067**	**8.488**	**0.000**	**0.874**
10-14	**Mining and Quarrying**	**0.214**	**0.065**	**3.252**	**0.001**	**0.394**	**0.296**	**0.110**	**2.699**	**0.025**	**0.366**	**0.175**	**0.067**	**2.617**	**0.026**	**0.399**
40-41	**Electricity, Gas and Water Supply**	**0.434**	**0.044**	**9.811**	**0.000**	**0.870**	**0.477**	**0.050**	**9.594**	**0.000**	**0.845**	**0.368**	**0.069**	**5.348**	**0.000**	**0.669**
45	**Construction**	**0.139**	**0.023**	**6.090**	**0.000**	**0.649**	**0.103**	**0.031**	**3.356**	**0.008**	**0.489**	**0.165**	**0.032**	**5.154**	**0.000**	**0.787**
50-52	Wholesale and Retail Trade, Repairs	0.256	0.020	12.752	0.000	0.890	0.235	0.018	13.044	0.000	0.935	0.281	0.036	7.812	0.000	0.816
55	Hotels and Restaurants	0.096	0.019	5.106	0.000	0.572	0.099	0.015	6.773	0.000	0.810	0.091	0.042	2.138	0.050	0.305
60-63	Transport and Storage	0.302	0.018	17.006	0.000	0.941	0.299	0.026	11.403	0.000	0.919	0.363	0.023	16.064	0.000	0.935
64	Post and Telecommunications	0.372	0.027	13.979	0.000	0.903	0.311	0.026	12.123	0.000	0.907	0.448	0.038	11.905	0.000	0.872

Note: The number of observations is not included, since for every period only the countries and industries that had data for all years were included. Therefore the number of observations was equal to the number of years in the period.

Table A.2 Continued

France

ISIC 3	Industry Name	81-01					81-90					91-01				
		Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.158	0.022	7.096	0.000	0.706	0.142	0.032	4.464	0.002	0.677	0.213	0.030	7.304	0.000	0.818
17-19	Textiles, Textile Products, Leather and Footwear	0.069	0.024	2.672	0.019	0.263	0.063	0.036	1.752	0.114	0.198	0.102	0.029	3.517	0.006	0.549
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.127	0.014	9.081	0.000	0.803	0.127	0.020	6.239	0.000	0.798	0.129	0.023	5.645	0.000	0.742
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.186	0.035	5.331	0.000	0.604	0.189	0.035	5.361	0.001	0.672	0.205	0.067	3.062	0.012	0.400
26	Other Non-metallic Mineral Products	0.129	0.047	2.745	0.013	0.199	0.102	0.064	1.584	0.148	0.128	0.262	0.076	3.443	0.006	0.499
27-28	Basic Metals and Fabricated Metal Products	0.003	0.024	3.436	0.003	0.327	0.071	0.034	2.004	0.067	0.292	0.139	0.036	3.904	0.003	0.555
29	Machinery and Equipment, n.e.c.	0.222	0.024	9.367	0.000	0.783	0.237	0.028	8.348	0.000	0.814	0.163	0.048	3.389	0.007	0.524
30-33	Electrical and Optical Equipment	0.149	0.017	8.659	0.000	0.757	0.159	0.013	12.405	0.000	0.910	0.105	0.047	2.254	0.048	0.336
34-35	Transport Equipment	0.089	0.033	2.671	0.015	0.178	0.057	0.040	1.441	0.183	0.088	0.150	0.057	2.636	0.025	0.344
36-37	Manufacturing nec; Recycling	0.156	0.020	7.879	0.000	0.753	0.164	0.026	6.366	0.000	0.784	0.119	0.037	3.196	0.010	0.421
01-05	**Agriculture, Hunting, Forestry and Fishing**	**0.431**	**0.032**	**13.571**	**0.000**	**0.898**	**0.478**	**0.038**	**11.175**	**0.000**	**0.915**	**0.440**	**0.069**	**6.371**	**0.000**	**0.799**
40-41	**Electricity, Gas and Water Supply**	**0.343**	**0.031**	**11.188**	**0.000**	**0.859**	**0.344**	**0.012**	**27.487**	**0.000**	**0.985**	**0.342**	**0.071**	**4.793**	**0.001**	**0.688**
45	**Construction**	**0.148**	**0.024**	**6.190**	**0.000**	**0.655**	**0.157**	**0.028**	**5.504**	**0.000**	**0.770**	**0.113**	**0.052**	**2.185**	**0.054**	**0.235**
50-52	Wholesale and Retail Trade, Repairs	0.235	0.039	6.051	0.000	0.646	0.226	0.049	4.577	0.001	0.699	0.261	0.073	3.586	0.005	0.557
55	Hotels and Restaurants	0.274	0.024	11.281	0.000	0.857	0.266	0.027	9.819	0.000	0.863	0.299	0.049	6.064	0.000	0.771
60-63	Transport and Storage	0.211	0.022	9.747	0.000	0.826	0.201	0.019	10.341	0.000	0.919	0.239	0.048	4.977	0.001	0.667
64	Post and Telecommunications	0.452	0.106	4.257	0.000	0.467	0.480	0.047	10.167	0.000	0.913	0.430	0.248	1.733	0.114	0.231

Great Britain

ISIC 3	Industry Name	81-01					81-90					91-01				
		Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.101	0.012	8.526	0.000	0.782	0.084	0.013	6.357	0.000	0.807	0.149	0.017	8.523	0.000	0.843
17-19	Textiles, Textile Products, Leather and Footwear	0.083	0.015	5.628	0.000	0.612	0.066	0.009	9.234	0.000	0.904	0.071	0.046	1.543	0.164	0.180
20	Wood and Products of Wood and Cork	0.139	0.019	7.132	0.000	0.709	0.146	0.022	6.608	0.000	0.829	0.099	0.046	2.126	0.059	0.021
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.111	0.014	7.692	0.000	0.736	0.103	0.020	5.160	0.001	0.747	0.129	0.023	6.009	0.000	0.690
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.040	0.035	1.143	0.287	0.206	0.056	0.051	1.079	0.309	0.244	0.041	0.042	0.963	0.358	0.139
24	Chemicals and Chemical Products	0.143	0.023	6.297	0.000	0.653	0.150	0.035	4.318	0.002	0.674	0.123	0.029	4.262	0.002	0.520
26	Other Non-metallic Mineral Products	0.170	0.023	7.223	0.000	0.720	0.183	0.024	7.667	0.000	0.861	0.049	0.073	0.681	0.506	0.035
27-28	Basic Metals and Fabricated Metal Products	0.059	0.022	2.642	0.016	0.234	0.063	0.029	2.148	0.060	0.300	0.036	0.042	0.866	0.412	0.057
29	Machinery and Equipment, n.e.c.	0.121	0.017	6.929	0.000	0.705	0.123	0.014	8.974	0.000	0.896	0.114	0.049	2.344	0.041	0.249
30-33	Electrical and Optical Equipment	0.114	0.021	5.462	0.000	0.598	0.121	0.023	5.313	0.001	0.752	0.087	0.049	1.774	0.107	0.200
34-35	Transport Equipment	0.018	0.028	0.634	0.534	-0.062	0.010	0.036	0.287	0.780	-0.393	0.040	0.063	0.753	0.469	0.053
36-37	Manufacturing nec; Recycling	0.112	0.012	9.051	0.000	0.790	0.100	0.010	9.529	0.000	0.906	0.160	0.029	5.521	0.000	0.465
01-05	**Agriculture, Hunting, Forestry and Fishing**	.	.	.	.	.	.	.	.	.	.	**0.288**	**0.074**	**3.913**	**0.003**	**0.599**
10-14	**Mining and Quarrying**	.	.	.	.	.	.	.	.	.	.	**0.755**	**0.094**	**8.051**	**0.000**	**0.886**
40-41	**Electricity, Gas and Water Supply**	.	.	.	.	.	.	.	.	.	.	**0.293**	**0.039**	**7.518**	**0.000**	**0.815**
45	**Construction**	.	.	.	.	.	.	.	.	.	.	**0.184**	**0.022**	**8.364**	**0.000**	**0.848**
55	Hotels and Restaurants	.	.	.	.	.	.	.	.	.	.	0.155	0.043	3.618	0.006	0.502

Italy

ISIC 3	Industry Name	81-01					81-90					91-01				
		Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.125	0.004	36.671	0.000	0.983	0.123	0.003	40.369	0.000	0.993	0.154	0.013	12.356	0.000	0.937
17-19	Textiles, Textile Products, Leather and Footwear	0.160	0.003	36.350	0.000	0.992	0.170	0.004	40.341	0.000	0.990	0.149	0.009	17.301	0.000	0.967
20	Wood and Products of Wood and Cork	0.214	0.006	38.000	0.000	0.986	0.214	0.006	35.667	0.000	0.992	0.214	0.021	10.153	0.000	0.895
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.154	0.008	20.190	0.000	0.950	0.163	0.007	21.698	0.000	0.978	0.186	0.039	4.742	0.001	0.689
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.036	0.029	1.228	0.234	0.010	0.060	0.018	2.798	0.022	0.185	-0.060	0.100	-0.597	0.564	0.030
24	Chemicals and Chemical Products	0.116	0.008	16.060	0.000	0.917	0.113	0.010	11.418	0.000	0.906	0.146	0.019	7.551	0.000	0.830
26	Other Non-metallic Mineral Products	0.215	0.007	31.948	0.000	0.979	0.239	0.008	29.640	0.000	0.986	0.126	0.020	6.271	0.000	0.982
27-28	Basic Metals and Fabricated Metal Products	0.144	0.006	25.937	0.000	0.969	0.146	0.006	22.324	0.000	0.978	0.130	0.018	7.051	0.000	0.830
29	Machinery and Equipment, n.e.c.	0.170	0.005	34.040	0.000	0.981	0.173	0.004	48.979	0.000	0.996	0.115	0.018	6.443	0.000	0.800
30-33	Electrical and Optical Equipment	0.174	0.005	32.263	0.000	0.979	0.178	0.004	47.992	0.000	0.995	0.124	0.020	6.143	0.000	0.795
34-35	Transport Equipment	0.095	0.008	11.922	0.000	0.870	0.092	0.007	13.401	0.000	0.936	0.157	0.025	6.329	0.000	0.774
36-37	Manufacturing nec; Recycling	0.184	0.005	36.867	0.000	0.988	0.186	0.007	25.287	0.000	0.985	0.168	0.010	16.211	0.000	0.956
01-05	**Agriculture, Hunting, Forestry and Fishing**	**0.420**	**0.012**	**36.163**	**0.000**	**0.984**	**0.410**	**0.007**	**61.078**	**0.000**	**0.997**	**0.550**	**0.039**	**14.155**	**0.000**	**0.947**
10-14	**Mining and Quarrying**	**0.570**	**0.023**	**24.385**	**0.000**	**0.964**	**0.570**	**0.020**	**29.110**	**0.000**	**0.986**	**0.475**	**0.092**	**5.171**	**0.000**	**0.716**
40-41	**Electricity, Gas and Water Supply**	**0.097**	**0.031**	**3.054**	**0.006**	**0.282**	**0.071**	**0.031**	**2.332**	**0.045**	**0.376**	**0.350**	**0.077**	**4.523**	**0.001**	**0.683**
45	**Construction**	**0.269**	**0.005**	**50.170**	**0.000**	**0.992**	**0.269**	**0.005**	**56.982**	**0.000**	**0.997**	**0.275**	**0.022**	**12.571**	**0.000**	**0.932**
50-52	Wholesale and Retail Trade, Repairs	0.477	0.007	65.140	0.000	0.995	0.491	0.004	112.776	0.000	0.999	0.422	0.032	13.305	0.000	0.944
55	Hotels and Restaurants	0.308	0.008	39.434	0.000	0.987	0.306	0.009	34.023	0.000	0.991	0.330	0.025	13.301	0.000	0.944

Note: The number of observations is not included, since for every panel only the countries and industries that had data for all years were included. Therefore, the number of observations was equal to the number of years in the period.

Table A.2 Continued (2)

New Zealand		81-01					81-90					91-01				
SIC 3	Industry Name	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2
15-37	**Total Manufacturing**	**0.148**	**0.010**	**13.652**	**0.000**	**0.901**	**0.139**	**0.015**	**9.110**	**0.000**	**0.870**	**0.154**	**0.015**	**10.564**	**0.000**	**0.917**
15-16	Food Products, Beverages and Tobacco	0.149	0.019	7.897	0.000	0.752	0.154	0.026	5.842	0.000	0.771	0.137	0.036	3.859	0.008	0.379
17-19	Textiles, Textile Products, Leather and Footwear	0.094	0.022	4.221	0.000	0.469	0.089	0.021	4.214	0.002	0.561	0.109	0.060	1.746	0.111	0.184
26	Other Non-metallic Mineral Products	0.256	0.032	7.909	0.000	0.757	0.243	0.030	8.307	0.000	0.799	0.202	0.077	4.307	0.002	0.572
27-28	Basic Metals and Fabricated Metal Products	0.146	0.025	5.888	0.000	0.628	0.134	0.030	4.504	0.002	0.584	0.231	0.069	3.908	0.003	0.485
36-37	Manufacturing nec; Recycling	0.153	0.024	6.447	0.000	0.671	0.162	0.030	5.467	0.000	0.713	0.109	0.061	2.119	0.060	0.266
01-05	**Agriculture, Hunting, Forestry and Fishing**	**0.383**	**0.023**	**16.956**	**0.000**	**0.935**	**0.377**	**0.025**	**15.024**	**0.000**	**0.951**	**0.414**	**0.056**	**7.326**	**0.000**	**0.735**
10-14	**Mining and Quarrying**	**0.358**	**0.085**	**4.204**	**0.000**	**0.458**	**0.339**	**0.135**	**2.508**	**0.033**	**0.261**	**0.423**	**0.087**	**4.850**	**0.001**	**0.647**
40-41	**Electricity, Gas and Water Supply**	**0.335**	**0.025**	**13.140**	**0.000**	**0.892**	**0.350**	**0.029**	**11.945**	**0.000**	**0.914**	**0.266**	**0.057**	**4.689**	**0.001**	**0.539**
45	**Construction**	**0.149**	**0.014**	**10.388**	**0.000**	**0.843**	**0.134**	**0.017**	**8.059**	**0.000**	**0.851**	**0.190**	**0.025**	**7.579**	**0.000**	**0.834**
50-52	Wholesale and Retail Trade; Repairs											0.291	0.060	4.863	0.001	0.644
55	Hotels and Restaurants											0.214	0.063	3.420	0.007	0.511
60-63	Transport and Storage	0.184	0.029	6.647	0.001	0.663	0.172	0.034	5.019	0.001	0.731	0.288	0.069	4.126	0.002	0.488
64	Post and Telecommunications	0.343	0.054	6.401	0.000	0.963	0.346	0.000	4.331	0.002	0.929	0.214	0.077	4.058	0.002	0.906

Belgium		81-01					81-90					91-01				
SIC 3	Industry Name	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.079	0.013	6.182	0.000	0.665	0.098	0.016	6.305	0.000	0.815	0.047	0.019	2.486	0.032	0.381
17-19	Textiles, Textile Products, Leather and Footwear	0.053	0.029	1.839	0.081	0.124	0.033	0.051	0.667	0.528	0.039	0.086	0.022	3.875	0.003	0.963
20	Wood and Products of Wood and Cork	0.105	0.039	2.663	0.015	0.257	0.116	0.066	1.768	0.111	0.247	0.087	0.043	2.035	0.069	0.292
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.150	0.023	6.466	0.000	0.675	0.152	0.025	6.127	0.000	0.806	0.143	0.052	2.743	0.021	0.429
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.022	0.030	0.763	0.454	0.026	-0.030	0.046	-0.657	0.528	0.011	0.061	0.038	1.629	0.134	0.205
24	Chemicals and Chemical Products	0.262	0.040	6.585	0.000	0.684	0.274	0.045	6.155	0.000	0.808	0.142	0.120	1.190	0.262	0.120
26	Other Non-metallic Mineral Products	0.176	0.030	5.886	0.000	0.631	0.181	0.027	6.699	0.000	0.837	0.163	0.072	2.253	0.048	0.333
27-28	Basic Metals and Fabricated Metal Products	0.135	0.038	3.566	0.002	0.385	0.131	0.047	2.763	0.022	0.417	0.143	0.077	1.908	0.083	0.254
34-35	Transport Equipment	0.100	0.019	5.288	0.000	0.563	0.097	0.025	3.904	0.004	0.608	0.104	0.030	3.481	0.005	0.540
36-37	Manufacturing nec; Recycling	0.066	0.032	2.035	0.065	0.166	0.081	0.030	2.672	0.026	0.438	0.037	0.062	0.598	0.570	0.031

Spain		81-01					81-90					91-01				
SIC 3	Industry Name	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.125	0.013	9.930	0.000	0.821	0.130	0.017	7.923	0.000	0.864	0.095	0.017	5.570	0.000	0.757
17-19	Textiles, Textile Products, Leather and Footwear	0.137	0.014	9.567	0.000	0.794	0.166	0.016	9.842	0.000	0.891	0.078	0.022	3.466	0.006	0.524
20	Wood and Products of Wood and Cork	0.152	0.025	5.978	0.000	0.600	0.164	0.039	5.009	0.001	0.714	0.097	0.061	1.706	0.119	0.189
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.187	0.026	7.298	0.000	0.720	0.208	0.038	5.431	0.000	0.797	0.099	0.022	4.593	0.001	0.673
23	Coke, Refined Petroleum Products and Nuclear Fuel											-0.120	0.113	-1.055	0.316	0.098
24	Chemicals and Chemical Products											0.081	0.026	3.129	0.011	0.425
26	Other Non-metallic Mineral Products	0.171	0.027	6.328	0.000	0.669	0.196	0.036	5.498	0.000	0.742	0.124	0.042	2.908	0.015	0.464
27-28	Basic Metals and Fabricated Metal Products	0.119	0.019	6.486	0.000	0.667	0.130	0.014	9.662	0.000	0.879	0.073	0.047	1.573	0.167	0.209
29	Machinery and Equipment, n.e.c.											0.095	0.030	3.216	0.009	0.508
30-33	Electrical and Optical Equipment											0.135	0.049	2.756	0.020	0.404
34-35	Transport Equipment	0.091	0.031	2.903	0.009	0.274	0.082	0.051	1.594	0.136	0.179	0.113	0.029	3.867	0.003	0.596
36-37	Manufacturing nec; Recycling	0.154	0.020	7.577	0.000	0.724	0.177	0.028	6.319	0.000	0.776	0.101	0.026	3.842	0.003	0.595

Denmark		81-01					81-90					91-01				
SIC 3	Industry Name	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2	Coefficient	Std Dev	t-stat	p-value	R2
15-16	Food Products, Beverages and Tobacco	0.075	0.015	4.960	0.000	0.549	0.078	0.015	5.231	0.001	0.745	0.065	0.038	1.722	0.116	0.297
17-19	Textiles, Textile Products, Leather and Footwear	0.124	0.017	7.270	0.000	0.716	0.123	0.020	6.266	0.001	0.764	0.130	0.030	4.309	0.002	0.577
20	Wood and Products of Wood and Cork	0.210	0.034	6.216	0.000	0.669	0.216	0.049	4.428	0.002	0.685	0.175	0.062	2.807	0.028	0.501
21-22	Pulp, Paper, Paper Products, Printing and Publishing	0.096	0.023	4.167	0.001	0.427	0.091	0.029	2.709	0.019	0.512	0.101	0.040	2.503	0.039	0.296
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.036	0.039	0.934	0.362	-0.048	0.071	0.077	0.930	0.377	-0.044	0.002	0.025	0.091	0.945	-0.076
24	Chemicals and Chemical Products	0.212	0.032	6.626	0.000	0.618	0.169	0.044	5.562	0.000	0.753	0.260	0.062	4.219	0.002	0.466
26	Other Non-metallic Mineral Products	0.166	0.029	5.826	0.000	0.605	0.175	0.036	4.882	0.001	0.722	0.148	0.060	2.460	0.044	0.344
27-28	Basic Metals and Fabricated Metal Products	0.116	0.027	4.345	0.000	0.440	0.097	0.035	2.742	0.023	0.601	0.200	0.070	2.863	0.016	0.398
29	Machinery and Equipment, n.e.c.	0.093	0.029	3.236	0.004	0.330	0.085	0.032	2.757	0.022	0.494	0.113	0.067	1.691	0.124	0.186
30-33	Electrical and Optical Equipment	0.109	0.032	3.414	0.003	0.365	0.111	0.025	4.403	0.002	0.693	0.107	0.083	1.295	0.262	-0.169
34-35	Transport Equipment	0.091	0.066	1.244	0.235	0.070	0.089	0.100	0.896	0.394	0.042	0.068	0.085	0.879	0.513	0.014
36-37	Manufacturing nec; Recycling	0.153	0.023	6.715	0.000	0.690	0.144	0.019	8.072	0.000	0.876	0.148	0.057	2.747	0.021	0.372
01-05	**Agriculture, Hunting, Forestry and Fishing**	**0.312**	**0.050**	**6.260**	**0.000**	**0.649**	**0.342**	**0.066**	**5.176**	**0.001**	**0.748**	**0.241**	**0.087**	**2.825**	**0.015**	**0.277**
10-14	**Mining and Quarrying**	**0.877**	**0.048**	**18.095**	**0.000**	**0.933**	**0.846**	**0.093**	**9.074**	**0.000**	**0.894**	**0.901**	**0.047**	**19.147**	**0.000**	**0.967**
40-41	**Electricity, Gas and Water Supply**	**0.432**	**0.055**	**7.840**	**0.000**	**0.729**	**0.374**	**0.088**	**4.263**	**0.002**	**0.667**	**0.530**	**0.056**	**9.509**	**0.000**	**0.858**
45	**Construction**	**0.055**	**0.029**	**1.923**	**0.069**	**0.156**	**0.047**	**0.026**	**1.840**	**0.099**	**0.251**	**0.075**	**0.064**	**1.174**	**0.268**	**0.104**
50-52	Wholesale and Retail Trade; Repairs	0.292	0.036	8.034	0.000	0.690	0.306	0.048	6.329	0.000	0.815	0.116	0.048	2.393	0.031	0.162
55	Hotels and Restaurants	0.216	0.030	7.207	0.000	0.700	0.164	0.022	7.479	0.000	0.865	0.187	0.043	4.309	0.000	0.709
60-63	Transport and Storage	0.131	0.020	6.436	0.000	0.642	0.148	0.025	5.814	0.000	0.787	0.103	0.024	4.333	0.003	0.214
64	Post and Telecommunications	0.250	0.055	4.533	0.000	0.409	0.225	0.060	3.753	0.007	0.469	0.273	0.056	4.891	0.000	0.379

Note: The number of observations is not indicated, since for every period only the countries and industries that had data for all years were included. Therefore, the number of observations was equal to the number of years in the period.